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TABLE OF ERRATA IN No. V. Vol. III.

Page.

4 line last *for* Portia *Nut* *read* Portia *Seed.*

6 ,, 4 *for* Star arise *read* Star Anise.

14 Table of Exports opposite Cocoanuts fresh *for* 5·340·493 *read* 340·493 and in the same line *for* 6·333 490 *read* 333 490.

Total—*for* 5·957 999 *read* 957 999 and in the same line *for* 7·503 292 *read* 1·503 292.

Page.

20 Add the following Note at the foot of the page.

Note.—The Numbers appended to each of the Oils throughout this Section refer to those of the Index at page 45—many Oils, being of little note, are omitted, but their names will be found in the Index.

138 line last but one—omit the Comma after Turkistan.

TABLE OF ERRATA IN No. VI. Vol. III.

Page.

163 line 9 *for Shorea robusta read* a *Dipterocarpaceous* tree.

215 ,, 8 Insert *Scævola Taccada* before *Excoecaria Camettia* to which and not to the former the succeeding remarks refer.

218 ,, 23 *for* houses *read* waves.

,, 25 *for* mile pond *read* Mill Pond.

219 ,, 1 Add at after shifting.

~~224 ,, 12 Note *for* oboti *read* oboloi.~~

~~,, 13 do *for* οβελοι *read* οβολοι~~

226 ,, 15 *for* two *read* too.

228 ,, last—although should not be in parenthesis.

230 ,, 9 add of after consist.

,, ,, 21 *for* cadeuceus *read* caduceus.

[redacted] ,, 20 *for* th *read* the.

,, ,, last *for* off *read* of.

209 ,, 9 *for* Observe *read* Obverse.

246 ,, 13 *for* face *read* pace.

257 ,, 3 *for* be *read* by.

258 ,, 16 *for* till *read* then.

,, ,, 11 add till, after Star.

261 ,, 6 *for* acacios *read* acacias.

263 ,, 1 *for* loose *read* lose.

264 ,, 4 *for* by *read* of.

264 ,, 17 *for* where *read* whose.

265 ,, 9 *for* accompany *read* accompanies.

266 ,, 12 *for* seriatum *read* seriatim.

267 ,, 6 omit comma after fastening.

267 ,, 25 *for* by *read* of.

273 ,, 7 *for* neuralgie *read* neuralgic.

273 ,, 14 *for* taste *read* state.

274 ,, 3 *for* Balsom *read* Balsam.

274 ,, 10 *for* and *read* of.

MADRAS JOURNAL

OF

LITERATURE AND SCIENCE.

NO. 5.—NEW SERIES.

October—December, 1857.

I. *Report upon the Oils of Southern India. By* LIEUT. H. P. HAWKES, S. A. C. G.

The following Report upon the oils of Southern India has been drawn up from notes taken during the formation of a collection of oils for the Madras Government. The statistics have been furnished by the Civil and Military authorities throughout the Presidency.*

The subject may be conveniently arranged under the following sections.

Sect. 1. Oil considered as an article of export trade.
2. Abstract of oil cultivation in the several districts of the Presidency.
3. A descriptive list of the oils of Southern India.
4. Remarks on the economical uses of oil in India.

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* NOTE.—It will be observed that in many parts, especially in Section 3, this report is almost identical with that in Class IV. of the Jury Reports of the Madras Exhibition of 1855. This arises from the writer of the present paper having been requested to perform the duties of reporter in that section, and from his having embodied in that report all the information on this subject collected up to that date.

SECTION. I.

Oil considered as an article of export trade.

Although the *number* of oil producing plants in Southern India, is very large, yet upon examination it will be observed, that of these but few are *cultivated* to any great extent; the larger proportion consisting of trees, shrubs, &c. growing in a wild state, the fruits of which are gathered by the poorer classes, and the oils expressed as necessity requires. These latter (with some exceptions) do not form articles of trade, nor are they usually procurable in the native bazaars.

Of animal oils, that extracted from the liver and other parts of various species of fish, chiefly on the Malabar Coast, now forms a source of considerable trade; whilst Petroleum is largely exported from our Burmese possessions to the manufacturing towns of Liverpool and Glasgow.

In taking a general view of these substances it seems advantageous to consider them under the following classes.

1*st Class.*—Those plants which are *cultivated* for the sake of their products.—Of these, the oil and cake form in some cases the only valuable part, whilst in others, as the Poppy, the plant serves many other purposes. This class includes the bulk of the oils exported from, and consumed in India, and comprises the following—Cocoanut, Gingely and its varieties, Lamp and Castor,* Ground nut, Linseed, Ramtill, Mustard erroneously called Rape, and Poppy; the essential oils of Cinnamon (from the bark and leaf,) and Cassia, Cloves and Sandalwood.† Fish oil and Petroleum being also valuable commercial products will be considered in this Section.

First in importance is Cocoanut oil which is yearly exported to a large extent from Malabar and the Western Coast, and in smaller

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* Note.—Throughout this report the word "Lamp oil" will be used to denote the oil obtained from the large seeded variety of the Ricinus communis used almost exclusively for burning in lamps, whilst the term "Castor oil" will be understood to refer to the medicinal product extracted from the Ricinus communis fructibus minoribus.

† For the Botanical names of these plants, see Section 3.

quantities from Rajahmundry and Tanjore. During the last five years (from 1850-51 to 54-5) not less than 70,09,818 gallons, valued at 15,73,528 Rupees (according to the custom house valuation) have been exported from this Presidency, the demand having in the same time increased from 6½ to 21⅗ lacs of gallons. In addition to this, dried kernels have been exported from Malabar alone to the value of 23,78,888 Rupees, and the fresh nut to the extent of Rupees 20,43,669, thus presenting a total of Rupees 59,96,085 in five years, or an average of nearly 12 lacs per annum on this one commodity alone. This is exclusive of the dried kernels and fresh nuts exported from Rajahmundry, Tanjore and Vizagapatam, which appear to be sent chiefly to other Indian ports.

Gingeley oil and its varieties are next in value as articles of commerce. They are very generally grown in all parts of the country, and enter more largely than any other oil into the home consumption of every class of natives.

They are exported in large quantities chiefly in the shape of seed. The quantity and value of oil and seed exported from the Madras territories for the last five years is as follows:—

Oil, gallons..	332,384..	Rs. 2,05,290
Seed, cwt..	..19,54,209..	Rs. 23,96,894
		Rupees..26,02,184

making an average of 5 lacs of Rupees per annum. Of this a very large portion is sent to France as will be seen by the following abstract of the quantity exported in 1852-53.

United Kingdom....	Seed. Cwt.	12,713	Oil. gall.	42,043
Ceylon..................	,,	590	,,	2,968
France..................	,,	2,87,225	,,	
Pegu....................	,,	741	,,	19,698
Bombay..................	,,	118	,,	
Malacca.................	,,	33	,,	3,593
Travancore..............	,,	148	,,	
Bengal..................	,,	0	,,	46
French Indian Ports. ..	,,	0	,,	27
Mauritius and Bourbon..	,,	0	,,	4,232

"Lamp oil" is grown very generally throughout the country. It was exported from Rajahmundry to the value of 32,607 Rupees in 1854-55; and from Guntoor, Nellore and Tanjore to the value of from 10 to 15,000 Rupees each yearly. Little, if any, is sent to England.

The total exports for the last five years are as follows:

Oil. Gall. 1,97,977 Rs. 98,875 | Seed. Cwt. 99,471 Rs. 1,13,370 making an average of about 42,349 Rupees per annum.

Castor oil, extracted from the small seeded variety of *Ricinus* is exported to a small extent for medicinal purposes.

Ground nut oil is exported chiefly from South Arcot and Madras. In 1850-51, the demand arose to no less than 1,10,566 gallons, but with the exception of the year 1853-54 the export has never subsequently much exceeded half that amount.

The abovementioned oils and seeds, until within the last few years comprised the bulk of the exports from this Presidency. Now however the following begin to be exported.

Mustard seed, to the amount of Cwt. 50,746, Rupees 11,5,477 has been shipped during the last five years, from the Ganjam and Vizagapatam Districts.

The cultivation and export of Linseed is on the increase. It is sent from the Guntoor, Nellore and Masulipatam Districts to the value of from 2 to 9,000 Rupees per annum.

The manufacture of Fish oil has lately become a very valuable source of industry. The trade is chiefly confined to the Western coasts, although small quantities for home consumption are made in the Northern Circars. Omitting the year 1854-55 which is unfavorable on account of the failure of fish, the average value of this export for the last five years, is Rs. 78,126.

Petroleum is sent from our Burmese possessions, but no correct statistics are at present available.

The oils of Cassia, Cinnamon and Sandalwood are chiefly exported from the Western Coast, the wood from which much of the latter is extracted, is obtained from Mysore.

2nd Class.—Those plants, &c. which *grow spontaneously* and are found in sufficient quantities to admit of the produce becoming an article of inland trade.

These are generally to be procured in large bazaars and include Margosa, Illoopoo, Pinnacottay, Kurunj, Coorookoo, Cât amunak, Piney tallow, Gamboge butter, the various Wood oils, the essential oils of Lemon grass, Roosa grass, Cageput and Camphorwood.

The increasing attention which has been given to this subject has resulted in the manufacture and export of the following oils, which were previously unknown to the market.

Piney tallow exported to the value of Rupees 4,350 in 1854-55 from Canara.

Lemon grass and Roosa grass oil exported from Malabar and Travancore (sometimes under the fictitious name of Oil of Geranium or Verbena.)

Gamboge butter, employed successfully as a lubricating agent for Railway carriages.

Illoopoo, Margosa and Pinnacottay exported to a limited extent for household purposes.

3rd Class.—Those plants &c. which *grow spontaneously* but *to a limited extent* in many parts of the country, the oils from which are sometimes extracted by the poorer classess for home consumption and are seldom procurable in the bazaar.

This class comprises the oils of Safflower, Belgaum wallnut, Poovana, Neeradimootoo, Addale (*J. Glauca*), Country-cress, Cheeronjie, Cucumber, Melon and Pumpkin, Coorgapilly, Sterculia, Wild olive, Cheeroo pinnacottay (*Cal. colaba,*) Sandal seed, Mooroogana tallow, Naga Sumpaghy and Caat Urraloo.*

4th Class.—Those plants &c. from which small quantities of oil are extracted chiefly for medicinal purposes and perfumery, including Soap nut, Cashew nut, Ben nut, Cotton seed, Silk Cotton seed, Sweet Fennel, Rosebay, Malkunganee, Hemp Seed, Portia nut, Vis-

* For the Botanical names of these plants, see Section 3.

cid Cleome, Thortay, Fænugreck, Abelmoschus seed, Gutta Percha seed, Croton, Bryony, Colocynth, Wild cummin, Bonduc nut, Mimusops, Moodooga, Thevetia, Oodul, Garlic, Sunflower, Wild almond, Star arise, Gayapa, Nutmeg (wild), Thorny Trichilia, Cyperus, Thorn apple, Condamminee, Sand box tree, Saul seed, Eugenia, Belleric Myrobalan, Chebulic Myrobalan, Kikuel, Bergera Kœnigii, Balanites Œgyptiaca, Radish seed, Cabbage seed, Cardamom, Poondy, Cordia, Girghitly, Jogyhulloo, Nux Vomica, Marking nut, Cashew husk, Oleum nigrum, Tobacco seed, Alligator pear oil, Cinnamon tallow, Cocculus oil, &c. &c. This class will also include, Neat's foot oil and oil of wax.

Excepting Croton oil which is manufactured for medicinal purposes to a small extent, none of the oils of the last two classes form articles of trade.

A reference to the table of exports will give a good idea of the extent of the trade in these commodities, the total value of oils and seeds exported for the last five years is as follows: (For the items vide Appendix A.)

Year	1850-1	Rupees	8,11,057	duty	24,331
,,	1851-2		6,42,439		19,273
,,	1852-3		11,31,578		33,947
,,	1853-4		15,58,222		46,746
,,	1854-5		11,41,617		34,248

A duty of 3 per cent. is levied on oils and oil seeds of all sorts, yielding an average annual revenue (for last 5 years) of 31,709 Rupees.

The quantity of the four principal oils annually imported into Great Britain is as under.

		Palm oil.		Cocoanut oil.		Castor oil.		Olive oil.
1848	Cwts.	510,218	Cwts.	85,463	Cwts.	4,588	Tons.	10,086
1849		493,331		64,452		9,681		16,964
1850		448,589		98,040		,,		20,738
1851		608,550		55,995		,,		11,503
1852		523,231		101,863		,,		8,898

The total value of oils exported from India exhibits an annual increase, the demand however for the various items of which the whole export is composed, fluctuates considerably.

In 1848-49 the quantity of oil shipped was less than in the preceding year, but Linseed and Ground nuts first formed regular articles of export.

In 1849-50 the demand for Cocoanut oil was doubled, that for Ground nuts trebled, and that for Gingely much increased.

In 1850-51 Gingely was exported to twice the amount of the previous year, and Ground nut continued to be largely shipped. Fish oil, was also made in large quantities.

In 1851-52 there was an increase of one-third in demand for Cocoanut, and of 100 per cent. for Fish oil, but Ground nut declined to one-third of its former export, Gingeley oil and seed also decreased, the latter to the extent of nearly one half of the former demand. This was on the whole a bad year for this branch of trade.

In 1852-53 there was a further increase in demand for Cocoanut oil which now more than doubled its export for 1850-51, also an immense increase in the export of Fish oil of upwards of 300 per cent. Mustard was exported to five times its former figure and Lamp oil and Ground nut advanced, Gingeley oil and seed remained the same as in 1850-51.

In 1853-54 the demand for oils of all sorts consequent on the war rose to an enormous extent, the quantity of all oils exported and especially of Fish, Ground nut and Gingeley, increased largely.

In 1854-55 the demand decreased considerably in consequence of the large supplies sent the previous year.

A remarkable specimen of the rise and progress of a new branch of industry is to be seen in that of the manufacture of Fish oil, the export of which has increased from 3,500 gallons in 1847-48, to 7,21,095 gallons in 1853-54.

From the above summary it will, I think, be sufficiently evident that the discovery or introduction of *new* articles of produce however desirable, is by no means so indispensable as is so often supposed. Efforts should rather be made to extend and improve the

cultivation of those oil seeds for which there is already a steady demand. The oil cultivation seems in a remarkable manner to accommodate itself to the demand, and there is but little fear of a deficiency of supply as long as remunerative prices are offered.

SECTION II.

Abstract of oil cultivation in the several districts of the Presidency.*

NORTH ARCOT.

The principal oils of this Collectorate are Gingeley and Lamp, both of which are cultivated very generally throughout the District. Castor, Cocoanut and Ground nut are produced to a limited extent.

The plants yielding Kurunj and Brumadundo also grow sparingly, the latter from its cheapness being frequently used in this and other collectorates to adulterate more expensive oils.

Exports, none.

SOUTH ARCOT.

Ground nut is the chief oil produced and exported in this District. Gingeley oil is also sent in tolerably large quantities to Europe, but the demand for both appears to fluctuate considerably. Mustard oil and seed have been lately exported, and the cultivation is on the increase. Cotton is grown on from 15 to 20,000 cawnies of land, but the oil of the seed is not extracted. Illoopoo oil is prepared to a limited extent and sold at Rupees 25 per Candy, and oil is obtained from both kinds of Physic nut and burned by the poorer classes.

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* Note.—The difficulty of obtaining accurate statistics of Agricultural Produce in India is very great; the system of sowing several crops in one field also tends to augment the labour. Although therefore the following returns are believed to represent a very fair approximation to the average amount of cultivation and export, yet too much reliance should not be placed upon these figures. As regards prices also some idea may be formed of their fluctuation and of the impossibility of basing any calculations on such data, by a return received from North Arcot, in which the prices of the same oil are shown to vary to the extent of one-third in different towns of the district.

EXPORTS.

NAMES.		1850-1		1851-2		1852-3		1853-4.		1854-5.	
		No.	Rs.	No	Rs.	No.	Rs.	No.	Rs.	No.	Rs.
CUDDALORE.											
Cocoanut Oil..	Candies.	0	0	0	0	0	0	0	0	35	1,860
Cocoanut Kernels	Do.	0	0	0	0	0	0	0	0	10	368
Gingely Oil....	Do.	311	12,154	$10\frac{1}{2}$	391	1	41	334	14,332	13	728
Gingely Seed...	Garces.	0	109	0	92	0	0	0	0	0	0
Lamp Oil.....	Do.	0	0	0	0	0	0	0	67	0	0
Ground nut Oil	Candies.	1,428	42,831	382	11,120	1,038	28,754	640	2,759	2,393	18,572
Ground nuts..	Garce.	0	109	0	92	0	0	0	0	0	0
Mustard Oil...	Candies.	0	0	0	0	0	0	0	24	0	0
Mustard Seed..	Garce.	0	0	0	0	58	667	62	823	0	0
Pinnacotay Oil	Candies.	0	0	0	0	0	26	0	0	0	0
PORTO NOVO.											
Gingely Oil...	Candies.	3	149	5	354	8	329	0	0	0	0
Gingely Seed..	Garce.	0	0	0	12	0	0	0	0	0	0
Lamp Oil .. .	Candies.	0	0	0	0	0	20	0	28	0	0
Ground nuts..	Garce.	0	0	0	3	0	140	1	154	0	0
Margosa Oil..	Candies.	0	9	1	37	0	24	0	0	0	69
	Total...	..	55,253	..	12,012	..	30,004	..	43,441	..	21,658

BELLARY.

The cultivation of Lamp and Gingely seeds extends over 88,950 and 7,177 acres respectively. Linseed, Safflower and Illoopoo oils are obtainable in small quantities. The Cocoanut oil consumed in this district is chiefly made from imported nuts.

CANARA.

Cocoanut oil and kernels, Gingely seed, Fish oil, Cassia and Sandalwood oils form the staple oil products of this district. Piney tallow has of late risen rapidly in demand. Fish oil is largely made and exported.

This district is moreover rich in oil bearing trees, many of the oils of which if obtainable in sufficient quantities, appear likely to become valuable. A list of some of these is subjoined.

TABLE OF EXPORTS.

NAMES.		1850-1 No.	1850-1 Rs.	1851-2 No.	1851-2 Rs	1852-3 No.	1852-3 Rs.	1853-4 No.	1853-4 Rs.	1854-5 No.	1854-5 Rs.
Cocoanut oil...	Candies.	6	311	18	838	20	914	22	1,082	103	5,932
Cocoanut kernels........	Do.	82	2,295	182	4,085	60	1,345	29	857	83	3,117
Gingely oil.....	Do.	$\frac{1}{4}$	19	$\frac{1}{4}$	15	2	129	2	86	48	2,671
Gingely seed...	In. Mds.	2,375	4,397	1,908	3,584	2,282	3,584	4,052	5,382	3,778	9,045
Castor oil......	Candies.	$\frac{1}{4}$	13	3	207	4	196	2	113	6	356
Castor seed.....	In. Mds.	0	0	0	0	19	19	0	0	0	0
Fish oil........	Candies	82	1,632	53	1,137	1,144	18,214	2,996	61,284	*75	1,988
Linseed	In. Mds.	0	0	0	0	0	0	0	0	189	4,202
Cassia oil......	Candies.	11	2,445	4	1,127	8	2,159	3	964	5	1,590
Sandalwood oil.	Do.	14	38,946	13	36,722	16	42,552	23	65,203	28	81,495
Pinnacotay oil.	Do.	2	101	$\frac{1}{2}$	18	$\frac{1}{4}$	7	3	115	3	112
Piney tallow...	Do.	0	0	0	6	0	7	$\frac{1}{2}$	23	71	4,350
	TOTAL..	..	50,159	..	47,739	..	69,126	..	135,109	..	114,858

* Consequent on the failure of the fish the quantity of oil exported this year was small.

List of Medicinal and other oils, &c. produced in Canara.

VERNACULAR NAMES.	BOTANICAL NAMES.	REMARKS.
Mooroogana oil.......	.... ?	Used as a cure for cattle wounded by Tigers.
Arasinagoorghy oil.....	Garcinia pictoria...	Lamps and Food.
Thoronagulloo oil.....	Dalbergia...... ?	For skin diseases
Kungan	Celastrus paniculata.	For ulcers and wounds.
Cât Ghairoo..........	.... ?	For sores in cattle.
Girghitly............	.... ?	Extracted from the pulp of the tree and considered valuable in Rheumatism.
Nagasumpaghy.......	Mesua ferrea... ?	For Lamps, sold at 4 Rs. per maund.
Thortay..............	.... ?	For sores.
Jogyhulloo..........	.... ?	For skin diseases.
Poondy oil...........	Myristica Malabarica.	Of two sorts, extracted from the seed and fruit. For burning in lamps.
Sahcottay...........	.... ?	For skin diseases.
Mahnaloo...........	.... ?	For lamps.
Soorty (or Neeradimootoo).	Hydnocarpus inebrians.	For cutaneous diseases.
CâtUrraloo(wildCastor)	.... ?	For lamps and in medicine.

CHINGLEPUT.

As there are no exports from this district, the oils in most general request for local consumption are those chiefly grown. Gingeley is sown to the extent of about 3,700 acres, Lamp oil 830 acres, and Illoopoo is produced over about 890 acres of ground. In addition to the above, small quantities of Ground nut, Castor, Pinnacotay, Brumadundco, Cât amunak and Neeradimootoo are produced, but not to a sufficient extent to form articles of trade.

COIMBATORE.

The Cocoanut oil used in this Collectorate is imported from Paulghaut. Gingeley and Lamp are grown for home consumption, Kurunj, Neem and Illoopoo trees grow wild, and the oils of the seed are extracted by the poorer classes.

CUDDAPAH.

Lamp oil seed is cultivated to the extent of about 75,000 acres, yielding 120 measures per acre, and Gingeley to the amount of about 10,000 acres, yielding 150 measures per acre. The Cocoanuts grown in the district are sold for culinary purposes, and the Cocoanut oil consumed on the spot is extracted from kernels imported from Canara.

Kurunj, Linseed, Safflower, Illoopoo and Cât amunak oils are prepared in small quantities.

GANJAM.

The relative proportion of land under cultivation in this district, with the following oils, appears to stand thus.

Cocoanut........	12,093 acres.
Gingeley........	6,738
Mustard........	2,006
Ramtill........	2,700

For some years past, large exportations of Gingeley oil have been made by French merchants.

The Ramtill is said to be chiefly used (on account of its cheapness) to adulterate the Gingeley and Castor oils, for this purpose it is mixed with those seeds before being put into the oil press.

Cocoanut oil is largely made at two places in the district, but little is exported except to Moulmein.

Kurunj oil, though rarely made, is sometimes exported to Madras. Mustard oil is extracted to a small extent, the seeds however are exported largely

TABLE OF EXPORTS.

NAMES.	1850-1.		1851-2.		1852 3.		1853-4.		1854-5.	
	Mds.	Rs.	Mds.	Rs.	Mds.	Rs.	Mds.	Rs.	Mds.	Rs.
Cocoanut oil..	6	45	0	0	26	260	31	273	34	261
Cocoanut kernels.	0	0	0	0	10	15	*280	1,209	0	0
Gingeley oil..	46	348	36	0	4	34	11	87	160	187
Gingeley seed	41,659	51,433	60,257	100,430	145,537	242,561	107,205	174,982	92,592	150,431
Rape seed....	0	0	0	0	2,663	2,220	4,764	3,970	4,223	3,519
Lamp oil.. ..	3	12	0	0	60	300	7	30	58	246
Lamp oil seeds	135	135	0	0	1,047	1,047	42	44	116	116
Ramtill......	661	551	34	28	2,250	1,857	769	642	1,014	845
Mustard oil..	6	0	0	0	0	0	0	0	0	0
Mustard seed.	8,697	13,045	5,311	7,966	19,110	28,058	3,462	5,248	7,874	11,812
Illoopoo oil..	318	2,123	0	0	0	0	12	82	48	323
Illoopoo seed.	0	0	0	0	24	12	0	0	0	0
Wood oil....	0	0	0	0	2	16	0	0	0	0
TOTAL..	51,538	67,697	65,639	108,923	170,732	277,276	116,588	187,209	106,121	168,892

* In addition to this, 20,000 dry nuts valued at 300 Rupees, and large quantities of the fresh nut for edible purposes, are produced annually.

GUNTOOR.

With the exception of a little Linseed, Lamp is almost the only oil plant cultivated in this district. The quantity of land under cultivation with this latter is 31,242 acres, the produce being about 4,400 candies, of which 1,400 candies have been annually exported by sea and land.

Linseed is sown rather extensively in furrows on the borders of fields in the Western Talooks.

Other oils, such as Cocoanut and Gingeley, are imported from Rajahmundry and other districts.

TABLE OF EXPORTS.

NAMES.	1850-1.		1851-2.		1852-3.		1853-4.		1854-5.	
	Mds.	Rs.	Mds.	Rs.	Mds.	Rs.	Mds.	Rs.	Mds.	Rs.
Lamp and Castor oil..	47	316	78	520	73	490	47	314	40	279
Lamp and Castorseeds	8,326	13,136	17,858	27,292	16,364	25,095	28,174	38,891	21,133	28,672
Linseed.....	1,462	1,594	1,609	1,777	3,414	3,583	2,956	3,208	583	659
TOTAL..	9.835	15,046	19,545	29,589	19,851	29,168	31,177	42,413	21,75	629,610

KURNOOL.

Lamp oil is most largely produced in this district The extent of cultivation is 26,200 acres, and the average crop (at 140 measures per acre) is 36,68,000 measures. Gingeley covers about 8,050 acres, the average produce is estimated at 80 measures per acre. Castor oil (medicinal variety) does not thrive well, and is therefore but little cultivated, Illoopoo and Safflower oils are produced in small quantities.

MADURA.

Gingeley and Lamp are the chief oil products of this district, the cultivation of each being 14,653 and 11,546 acres respectively. Illoopoo, Neem and Kurunj are extracted to the extent of from one to three thousand gallons annually, and Brumadundoo and Cât amunak in smaller quantities.

TABLE OF EXPORTS.

NAMES.		1850-1		1851-2		1852-3		1853-4		1854-5.	
		No.	Rs	No.	Rs.	No.	Rs.	No.	R.	No.	Rs.
Gingeley oil..	Cwt.	18	102	5	56	7	72	0	0	1	13
Gingeley seed.	Cwt.	0	0	0	0	0	0	20	70	0	0
Lamp oil.....	Cwt.	29	165	19	143	50	363	120	864	0	6
Lamp oil seed	Cwt.	11	19	0	0	0	0	5	13	0	0
Margosa oil..	Cwt.	9	90	0	0	0	0	22	0	0	0
Total...		67	456	24	199	57	435	167	947	1	13

MALABAR.

This district, so rich in natural productions of every sort, yields a great variety of substances from which oils may be derived. Up to this time sufficient data as to the extent of cultivation,

&c. has not been obtainable, but the interest which has been evinced in elucidating this subject, will doubtless result in making known those oils which are likely to become valuable articles of trade.

The subjoined table will give the best idea of the ordinary products of the district.

TABLE OF EXPORTS.

NAMES.		1850-1.		1851-2.		1852-3.		1853-4.		1854-5.	
		No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.
Cocoanut oil.	Cwt.	47,726	147,983	68,931	213,966	104,368	3,22,674	132,176	406,347	158,100	549,701
Cocoanuts fresh......	No.	2,637,712	5,340,493	37,676,345	492,735	38,089,800	4,98,096	2,549,977	6,333,490	28,965,500	378,855
Cocoanuts dry.......	Cwt.	116,300	448,143	130,391	511,133	155,232	543,308	128,356	500,312	95,504	375,992
Gingeley oil.	Cwt.	10	123	0	0	40	383	860	6,350	370	2,671
Gingeleyseed	Cwt.	671	2,143	0	0	670	1,467	3,663	11,767	617	2,711
Fish oil.....	Cwt.	3,029	12,461	7,242	29,785	21,046	84,577	47,057	234,657	5,865	81,538
Pinnacotay oil........	Cwt.	160	457	260	875	506	1,300	922	2,414	651	1,611
Pinnacotay seed......	Cwt.	0	0	0	0	0	0	724	2,282	45	144
Cassia oil...	Cwt.	0	0	0	80	0	49	2	230	0	0
Lemon grass oil.......	Doz.	0	0	23	414	14	252	25½	459	13	233
Sandalwood oil	Cwt.	12	6,098	19	9,383	21	16,145	6	3,406	12	7,139
Croton oil...	Cwt.	0	98	0	708	0	36	0	167	0	8
Croton seed..	Cwt.	0	0	0	0	0	0	137	1,411	160	1,664
TOTAL..		2,805,610	5,957,999	37,883,211	1,259,079	38,371,697	1,468,287	2,863,905	7,503,292	29,226,837	1,402,267

MASULIPATAM.

Gingeley and Lamp oils are the staple products of this district, the former is said to be cultivated to the extent of about 10,000, and the latter about 15,000 acres. There are but few cocoanut plantations, this oil is therefore chiefly imported, but there is ample room for the introduction of this productive cultivation.

Fish oil is made for local consumption from fish caught on the Colar lake and on the coast, it is chiefly burnt in lamps by the lower classes, but the manufacture appears deserving of encouragement. Small quantities of Castor, Kurunj, Margosa and Bramadundoo are also made.

TABLE OF EXPORTS.

NAMES.		1850-1.		1851-2.		1852-3.		1853-4		1854-5.	
		No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.
Cocoanut oil	Candy	0	0	0	0	0	0	20	0	1	0
Cocoanuts...	Do.	3	0	0	0	0	0	0	0	0	0
Gingeley oil..	Do.	0	0	7	0	8	0	77	0	39	0
Gingeley seeds......	Garce.	0	0	0	0	0	0	0	0	5	0
Lamp oil....	Candy.	0	0	2	0	7	0	37	0	46	0
Lamp seeds..	Garce.	9	0	12	0	230	0	42	0	48	0
Linseed oil. .	Candy.	0	0	1	0	0	0	3	0	6	0
Ghee........	Candy.	57	0	36	0	1,209	0	427	0	130	0
	Total..	69	..	58	..	1,454	..	606	..	275	

NELLORE.

Lamp-oil is grown in this Collectorate to the extent of 12,500 acres.

The cultivature of the Gingeley seed covers on an average about 1,000 acres. Margosa oil is made to the extent of about 1,600 Maunds, and Illoopoo about 5,000. Brumadundoo, Cucumber and Linseed are all produced to a limited extent in the Ongole Talook.

TABLE OF EXPORTS.

NAMES.	1850-1.		1851-2.		1852-3.		1853-4.		1854-5.	
	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.	Cwt.	Rs.
Gingeley oil..	243	846	35	313	18	121	50	438	51	450
Gingeley seed.	11,411	120,445	8,123	74,369	2,685	17,233	1.869	7,209	395	978
Lamp oil......	197	1,549	239	1,897	187	1,470	158	1,275	163	1,196
Lamp seed....	15,121	113,550	240,961	76,660	23,042	169,784	15,076	90,450	3,364	0
Linseed..	0	732	117	689	242	1,426	127	741	17	25
Cucumberseed	0	0	0	8	14	59	11	44	0	4
Total.	26,972	237,122	249,457	153,936	26,188	190,093	17,291	100,157	3,990	2,653

RAJAHMUNDRY.

In this district the oil seeds principally grown appear to be those of Gingeley, Cocoanut and Lamp.

Of Lamp and Gingeley upwards of 14,000 acres each are said to be cultivated, and considerable quantities of the latter seed have within the last few years been exported to France. Cocoanuts are grown in various talooks, and might be planted to a large extent if necessary. Castor, Kurunj, and Margosa oils are also prepared for local consumption.

TABLE OF EXPORTS.

NAMES.		1850-1.		1851-2.		1852-3.		1853-4		1854-5	
		No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.
Cocoanut oil...	Mds.	1,673	3,330	2,420	5,094	2,139	5,108	5,132	10,692	1,758	5,681
Cocoanutsfresh	No.	996,308	13,099	420,368	5,495	495,560	6,494	1,521,369	19,907	917,474	11,770
Cocoanutsdried	Mds.	718	532	105	115	267	222	1,518	1,518	147	227
Gingeley oil. ..	Mds.	1,088	2,092	1,248	2,510	4,087	7,852	3,508	7,574	928	2,914
Gingeley seed..	Parahs.	52,599	110,884	42,279	98,564	72,274	163,215	107,612	312,978	40,922	183,461
Lamp oil..	Mds.	2,509	4,142	2,612	2,833	10,705	119,725	1,885	3,265	3.917	8,203
Lamp seed....	Parah.	2,598	4,960	8,766	7,824	39,985	52,785	2,871	5,801	9,778	84,404
Castor oil.. ...	Doz.	79½	410	10	45	0	0	2	5	0	0
Linseed oil....	Mds.	2	6	3	9	0	24	0	0	1	3
Wood oil......	Mds.	38	132	14	42	28	84	0	0	105	217
Mustard seed..	Mds.	1,094	544	1,371	1,175	1,035	523	190	88	0	0
Cotton seed...	Mds.	0	0	0	0	1,039	259	2,703	666	1,093	873
Cinnamon seed	Mds.	16	24	30	100	0	0	36	105	2	9
	Total..	..	140,155	..	123,806	..	356,291	..	362,599	..	297,762

SALEM.

Lamp and Gingeley are cultivated throughout the district, the former to the extent of 39,300 acres, yielding on an average 160 measures per acre, and of the latter 18,525 acres yielding 150 measures per acre. Ramtill is also cultivated in the Oosoor, Denkencotta and Tripatore talooks. Illoopoo, Cât amunak, Kurunj, Neem and Brumadundoo grow spontaneously, and the latter is said to be also cultivated to a small extent.

TANJORE.

Cocoanuts form the chief oil product of this fertile district, the quantity of ground under cultivation being estimated at 4,369 acres, producing on an average 5,447 nuts per acre.

Next in importance are Illoopoo grown over 6,000 acres, Castor occupying 1,493 acres, and Gingely cultivated to the extent of 1,207 acres. Pinnacotay and Ground nut oils are produced to a limited extent. A great variety of Medicinal oils &c. are obtainable in this district.

Table of Exports.

NAMES.		1850-1.		1851-2.		1852-3.		1853-4		1854-5	
		No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.
Cocoanut oil...	Cwt.	54	549	169	1,712	125	1,264	64	647	18,104	19,194
Cocoanuts	No.	41,375	580	29,375	384	0	0	0	0	0	0
Gingeley oil..	Cwt.	623	6,288	455	4,588	556	5,609	1,085	10 966	202	2,765
Gingeley seed..	Cwt.	67	175	81	226	265	691	7,654	20,925	0	0
Lamp oil.	Cwt.	796	5,707	1,175	8,429	1,366	9,797	448	16,121	2,268	16,264
Lamp seed ...	Cwt.	1	3	0	0	0	0	0	0	0	0
Illoopoo oil....	Cwt.	3	27	4	36	12	111	0	0	3	35
Margosa oil. ...	Cwt.	109	857	1,207	1,002	35	1,689	46	362	197	1,546
Pinnacotay oil..	Cwt.	12	84	22	210	130	866	0	5	4	30
Pinnacotay seed	Cwt.	10	19	46	108	83	153	10	30	12	21
Ground nuts...	Cwt.	72	165	42	96	366	1,002	90	299	15	60
Total..		..	14,454	..	16,791	..	21,182	..	49,358	..	39,915

TINNEVELLY.

The oils in general demand for local consumption are here largely cultivated. Lamp to the amount of 34,785 acres and Gingeley 18,222 acres.

Illoopoo oil is procurable in large quantities (about 16,000 Gallons,) and if advances are made to the manufacturers of Wood oil, a good supply is obtainable, the quantity however at present extracted for home consumption is very small.

Castor, Safflower, Margosa, Pinnacotay, Kurunj, Brumadundoo, Cât amunak and Poovana oils are all procurable in quantities varying from 5 to 250 Gallons.

TABLE OF EXPORTS.

NAMES.		1850 1.		1851-2.		1852-3.		1853-4.		1854-5.	
		No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.
By Sea.											
Gingeley oil.	Mercal	40	107	15	67	69	180	435	1,143	135	365
Gingeley seed......	Do.	0	0	0	0	50	36	365	268	2,575	1,887
Lamp oil....	Do.	0	0	0	0	44	115	15	40	41	108
Lamp oil seed......	Do.	6	3	0	0	2	1	30	40	56	28
Margosa oil..	Do.	5	12	43	107	94	236	21	52	68	170
To Travancore.											
Gingeley oil.	Mercal	1,094	2,872	591	1,553	1427	3,747	2,020	5,303	1,171	3,075
Gingeley seed......	Do.	14,462	9,900	5,043	3,708	19,751	14,524	17,333	14,217	7,584	5,538
Lamp oil....	Do.	72	189	14	37	0	0	0	0	0	0
Lamp seed..	Do.	363	148	190	94	0	0	0	0	0	0
Margosa oil..	Do.	19	48	0	0	0	0	0	0	0	0
Margosa seed	Do.	402	474	0	0	0	0	0	0	0	0
TOTAL..		..	13,713	..	5,566	..	18,839	..	21,063	..	11,171

TRICHINOPOLY.

"Most of the oils usually grown are produced in this district. The supply however being insufficient to meet the local demand, the deficiency is imported from Salem, Coimbatore and the neighbouring Collectorates.

VIZAGAPATAM.

According to the returns furnished from this district the following appears to be the proportion in which the several oils therein mentioned are cultivated. Owing however to the great difficulty of obtaining correct information, these numbers must be considered only as an approximation.

Lamp oil 40,000 acres, Gingeley 27,000 acres.
Mustard, 25,000 acres, Putty Gingaloo 10,000 acres.
Ramtill, 3,500 acres.

Illoopoo, Margosa, Brumadundoo, and Cât amunak oils are also procurable in quantities of from 200 to 1,000 maunds.

TABLE OF EXPORTS.

NAMES.		1850-1.		1851-2.		1852-3.		1853-4.		1854-5.	
		No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.
Cocoanut oil.	Mds.	0	0	0	0	14	42	0	0	7	27
Cocoanuts...	No.	664,455	2,681	0	0	465,850	6,091	270,000	3,530	0	0
Gingeley oil.	Mds.	4,702	9,405	218	437	1,020	2,040	566	1,132	124	248
Gingeley seed......	Parahs	70,319	109,858	49,422	77,224	85,111	132,986	103,424	161,459	50,192	78,426
Rape.......	Mds.	0	0	800	1,200	487	731	0	0	0	0
Rape seed...	Parahs	1,845	1,504	1,046	1,054	3,016	2,262	16,066	12,049	10,338	793
Lamp and Castor....	Mds.	57	115	1,063	2,126	917	1,834	738	1,477	16	33
Lamp seed..	Parahs	2,930	4,945	50	84	3,396	5,734	12,663	21,370	2,554	4,310
Mustard seed	Do.	6,821	14,474	7,869	16,709	11,722	24,911	4,099	8,710	5,164	10,973
Avesa oil....	Mds.	0	0	0	0	0	0	0	0	20	30
Lemon grass.	Mds.	0	0	0	0	1	14	0	0	0	0
Croton oil...	Mds	0	0	0	0	28	128	0	0	0	0
TOTAL..		..	142,982	..	98,834	..	176,773	..	209,727	..	94,840

MALWA.

Opium being the staple product of this province, Poppy oil and seed (the former at 9 seers, and the latter at 25 seers per Rupee) are procurable to a very large extent. Poppy oil is here more generally used than any other both in Lamps and as food.

Mahowa oil selling at 1 anna 6 pie per seer, and a little Mustard oil are the only other oils made in this province, excepting two very inferior ones extracted from the seeds of the Ramayen and the Kunjee (*Dalbergia ?*) and burnt in lamps by the poorer classes.

MYSORE.

Lamp and Castor, Gingeley and Ramtill appear to be the chief oil products of Mysore.

Most of the oils however in Classes 2 and 3 are procurable. Of these the Kurunj, Brumadundoo (largely used for lamps), Cât amunak and Neem are the principal, the latter is said to grow most plentifully in the Chittledroog Division.

The Poppy is cultivated in the Chickmugaloor talook, and Linseed, Safflower and Mustard in various parts of the country. Sandalwood oil is largely made. Cassia, nutmegs and pepper grow wild in the jungles.

The *Garcinia pictoria* is plentiful in the jungles in the West of Mysore, and yields a valuable solid oil. A very sweet tasted edible oil is also obtainable from the seeds of the *Chirongia sapida.*

SECTION III.

DESCRIPTIVE LIST OF THE OILS OF THE MADRAS PRESIDENCY.

CLASS 1.

No. 1. *Cocoanut oil.* (*Cocos nucifera.*)

The Cocoanut Palm grows almost every where within the tropics. It is plentifully cultivated in the districts of Malabar and Canara, Ganjam and Rajahmundry.

The oil is generally prepared from the dried kernel of the nut, by expression in the ordinary Native mills. When carefully made it is colorless, solid at low temperatures but possesses a rancid disagreeable smell.

When required for edible purposes, the kernel of the fresh nut is taken, rasped and mixed with a little boiling water. This yields

by pressure a milky fluid which, on being boiled until all the water has evaporated, produces a clear edible oil. Only just sufficient water to moisten the pulp should be added, as a larger proportion prolongs the operation and deteriorates the product. When fresh prepared, this oil is comparatively free from smell, but it speedily acquires an unpleasant odour; many attempts have been made to divest the oil of this smell, which renders it inapplicable for the perfumers' use, but only with partial success.

The prices of this oil vary most considerably in different parts of the country. For the quarter ending 31st October 1854, the maximum and minimum prices at nineteen large stations in all parts of the Presidency were Rs. 8-5-4 at Jubbulpore, and Rs. 2-14-0 at Bangalore, per maund. The average of twenty-one large stations in the Madras Presidency gives Rs. 4-9-5 per maund or about £41-2 per ton. The market value of "Cochin oil" in London in January 1855 was £46-10 per ton, the average being from £46 to £48.

It is used very largely in England in the manufacture of candles and soap. For the candle maker the stearine is separated from the olein, the former product being used for candles, for which it is most applicable on account of the high temperature required to fuse it. The olein is then made over to the soap boiler for conversion into soap. Soap made from Cocoanut oil is lighter than water, and consequently floats in that medium, whilst from its being the only soap which will dissolve freely in salt water it is usually called "Marine soap."

In India this oil is made into soap by boiling with a proper proportion of dhobies' earth, salt, saltpetre, quicklime, and water. It is also burnt in lamps by the higher classes, used for anointing the body, and in cookery.

The best oil is exported from Cochin and the neighbouring ports on the Malabar coast. It usually fetches 20*s.* per ton more than the Ceylon or Coromandel coast article. The average annual quantity exported from this Presidency from 1850-1 to 1854-5 is about 14,10,963 gallons. Of this by far the largest portion is sent to the United Kingdom and France, the remainder finding its way to Arabia, Mauritius, Bombay and the French (Indian) Ports.

The Cocoanut palm thrives best near the sea coast, although it sometimes grows favorably on inland plains, the soil of which contains a large proportion of silex and soda or salt which are the substances chiefly required for its nourishment. In South America salt is largely used as a manure. The tree begins to bear about the 7th or 8th year, the annual produce being from 70 to 100 nuts. At the Tanjore local Exhibition in March 1856, a bunch of Cocoanuts containing no less than 70 nuts on a single stalk was exhibited. Each tree is calculated to yield at least 2½ gallons of oil per annum, and the coir obtained from the nuts is estimated to yield one fourth of the value of the oil, whilst the oil cake is very valuable for cattle and as a manure. The Elephant beetle (Oryctes Rhinoceros) is a great enemy of this tree, it begins by nibbling the leaves into the shape of a fan, and then attacks the main shoot into which it bores, and unless speedily extracted, infallibly destroys the tree.

No. 2. *Gingeley oil.* (*Sesamum orientale.*)

The Sesamum and its varieties are grown throughout the country. So universal is the use of this oil, that its name in almost all the vernacular languages signifies " the oil."

The mode of extraction sometimes adopted is that of throwing the fresh seeds without any cleansing process, into the common mill and expressing in the usual way. The oil thus becomes mixed with a large portion of the coloring matter of the epidermis of the seed, and is neither so pleasant to the eye nor so agreeable to the taste as that obtained by first repeatedly washing the seeds in cold water, or by boiling them for a short time until the whole of the reddish brown coloring matter is removed, and the seeds have become perfectly white; they are then dried in the sun, and the oil extracted as usual.

In expressing this oil, the Natives of the Northern division always add the bark of the Tanghedi (Cassia auriculata), or the Babool gum to the seed to be pressed, this is probably done with a view of enhancing the value of the cake, which is used as an article of food for man and beast.

The value of this oil in England was £47-10 per ton in January 1855, and £49 to £53-10 in January 1856. In different parts of

the Presidency, the price of this oil varies from Rs. 1-5-0 to Rs. 6-0-0 per maund of 25 lbs. In South Arcot it is procurable at Rs. 27-12-5 per candy.

The prices per maund at the undermentioned stations, for the quarter ending 31st October 1854, were as follows:

	R.	A.	P.		R.	A.	P.
Arcot	3	8	0	Madura	5	8	3
Bangalore	3	7	3	Mangalore	4	1	8
Bellary	3	2	0	Nagpore	1	12	0
Berhampore	2	8	0	Palamcottah	4	12	0
Cannanore	6	0	0	Paulghaut	3	7	0
Cuddapah	2	13	0	Samulcottah	2	10	8
Jaulnah	2	6	0	Secunderabad	2	3	11
Jubbulpore	1	5	0	Trichinopoly	4	1	8
Madras	3	14	0	Vellore	3	14	0
Masulipatam	3	0	0	Vizagapatam	3	2	0

In England this oil is chiefly used for the manufacture of soap, and for burning in Table lamps, for which it is better suited than Cocoanut oil, owing to the lower temperature at which it congeals, although the light it gives is not so bright. In India it is chiefly used in cooking, for anointing the body, for making soap, for burning in lamps, &c. by the dyer to brighten and fix his colors.

The following tables will show the quantity and the destinations of the exports of this oil.

Year 1847-8.					Year 1848-9.				
Oil	Gals.	19,520	Rs.	14,776	Oil	Gals.	52,721	Rs.	36,294
Seed	Qr.	17,518	Rs.	160,134	Seed	Cwt.	1,44,125	Rs.	299,412
Year 1852-4.					**Year 1854-5.**				
	Gals	119,180	Rs.	73,635		Gals	17,139	Rs.	12,720
	Cwt	1,198,079	Rs.	693,760		Cwt	167,324	Rs.	431,726

		Seed.		Oil.
Exported to the United Kingdom	Cwt.	12,713	Gals.	42,043
Ceylon		590	—	2,968
France		2,87,225		
Pegue		741	—	19,698
Bombay		113		
Malacca		33	—	3,593
Travancore		148		
Mauritius and Bourbon		..	—	4,232

No. 3. *Bastard Gingeley oil.* (*Sesamum orientale var.*)

The "second sort Gingeley" sometimes called "bastard Gingeley" is extracted from a variety of the Sesamum above mentioned. It differs but little from the true Gingeley; the quantity of oil yielded by an equal amount of seed is somewhat less, but there appears to be no difference in the quality of the product.

The following remarks upon the cultivation of the true Gingeley, and its varieties in the Rajahmundry district, have been furnished by. F. Coplestone, Esq.

Gingeley, or first sort Gingeley. (The black seed.) This is the produce of the Hill-country called Reddyseema in the Rajahmundry district. It is generally sown at the commencement of the monsoon (June) and ripens in four months, 160 seers of seed yield 50 seers of oil which is clear and sweet. The current value of the seed is Rupees 50 per candy of 500lbs.

Bastard Gingeley, or second sort Gingeley, is the worst variety of this plant, the seeds are of mixed colors, white, red and black. It is usually sown in the month of Chyteari (April) and ripens in three months, 160 seers of seed yield 35 seers of oil, which is of a brown color and bitter. The current value of this seed is 35 Rupees per candy of 500lbs.

White Gingeley, is sown in the month of Myglam (January, February) and ripens in three months and a half. The oil is clean and sweet, 160 seers of seed yield 44 seers of oil, the current value of the seed is 44 Rupees per candy.

Pyroo Noovooloo is the red seed sown generally on the islands called Lunkaloo. It ripens in three months, 160 seers of seed yield 45 seers of oil. The current price of the seed is Rupees 42 per candy. The term "*Pyroo*" is applied to the season after the general harvest in January, viz. February, March, and April, and has no reference to these seeds except as indicating the time of their sowing.

The exports of this oil and seed are included in those of Gingeley.

No. 4. *Lamp oil.* (*Ricinus communis fructibus majoribus.*)

The oil obtained from the large seeded variety of the Ricinus

communis has obtained the above name from the fact of its being used almost solely for burning in the commonest lamps and for feeding torches.

For this purpose the seeds are sometimes partially roasted to coagulate the albumen and liquify the oil, and then pressed in the ordinary mill, or boiled with water, or the roasting process is omitted; in either case the coloring matter of the husks of the seed and other impurities gives the oil a dark color, and if the roasting process is carried too far, a slightly empyreumatic odour is communicated.

By carefully shelling the seed and rejecting all impurities, the Natives prepare a clear oil for medicinal purposes (by boiling) nearly equal to that extracted from the small seeded variety.

The price of this oil varies in different parts of the country from Rupees 1-10-0 to Rupees 3-13-6 per maund of 25 lbs. The average of nineteen large stations in all parts of the Presidency for the Quarter ending 31st October 1854, was Rupees 2-8-6 per maund.

It is chiefly used for burning in lamps, and from its viscidity and drying qualities only in those of the simplest description.

The average export of this oil for the last 6 years has been 97,561 Gallons per annum.

Lamp oil made into a kind of *palmine* by agitation with nitric acid, is largely used as a lubricating agent for Railway locomotives in India.

No. 5. *Castor oil.* (*Ricinus communis, fructibus minoribus.*)

The small seeded variety of the Ricinus communis is supposed to yield the best product, and is therefore universally employed in preparing the oil exported to Europe for medicinal purposes.

The fresh seeds after having been sifted and cleaned from dust, stones, and all extraneous matters, are slightly crushed between two rollers, freed by hand from husks and colored grains, and enclosed in squares of clean gunny or canvass. The packets of seed then receive a slight pressure in an oblong mould which gives an uniform shape and density to them. The "bricks" as they are

technically called, are then placed alternately with plates of sheet iron in the ordinary Screw or Hydraulic press. On the application of a gradually increasing pressure, the oil exudes through the pores of the gunny and is received into clean tins. Water in the proportion of a pint to a gallon of oil being added, the whole is boiled until the water has evaporated, the mucilage will be found to have subsided and encrusted, the bottom of the pan whilst the albumen solidified by the heat forms a thin layer between the oil and the water. Great care must be taken to remove the pan from the fire the instant the whole of the water has evaporated, which may be known by the bubbles having ceased, for if allowed to remain longer, the oil which has hitherto been of the temperature of boiling water or 212°, suddenly rises to that of oil or nearly 600°, thereby heightening the color and communicating an empyreumatic taste and odour. The oil is then filtered through blanket, flannel or American drill, and put into cans for exportation. It is usually of a light straw color, sometimes approaching a greenish tinge.

The cleansed seeds yield from 47 to 50 per cent. of oil. The following is the result of experiments made at Madras and Calcutta to ascertain the per-centage of oil in Castor seed (January 27th, 1853.)

Calcutta—1,400lbs. of seed yielded kernels and raw oil as follows:

	Kernels.	Oil.
1st sort	632lbs.	324lbs.
2nd sort	184lbs.	87½lbs.
3rd sort	164lbs.	76½lbs.

Making a total of 980lbs. of Kernels and 483lbs. of Raw oil from 1,400lbs. of seed.

Madras—1,400lbs. of seed yield raw oil as follows:

1st sort.	318lbs.
2nd sort.	88lbs.
3rd sort.	74lbs.

Making a total of 480lbs. of oil from 1,400lbs. of seed.

The cost of the Madras oil is as follows:—

	Rs.		
1,400lbs. of seed at Rs. 3-5-0 per bag of 164lbs. Rs.	27	3	4
Husking and selecting Kernels and cooly hire......	3	11	9
Crushing, moulding, pressing, boiling.............	2	7	1
Filtering and Sundries............................	2	8	0
Overseer's pay, Godown rent.......................	1	6	2
300 Empty Quart bottles, Corks, &c.............	34	4	8
Cleaning and Packing Charges......................	4	8	0
Total Rs...	76	1	0

Deducting the price of the bottles, this gives an average of annas 1 pies $4\frac{17}{24}$ per quart of first, second, and third sort oil.

This oil is chiefly used as a mild purgative, and by Natives for anointing the head. Soap of good quality may be made from it, but the cost and disagreeable smell which it communicates, preclude its general use.

The average export from the year 1849-50 to 1852-3 was 11,325 gallons per annum.

The method of extracting this oil by the boiling process is thus given by Ainslie. " The seeds are boiled for two hours in water, dried for 3 days in the sun, husked and pounded. They are then boiled in fresh water until the whole of the oil has risen to the surface."

Castor oil being entirely soluble in highly rectified alcohol of sp. grav. ·825, any adulteration of it with other fixed oils may be ascertained by dissolving a sample in 8 times its weight of spirit, the fixed oil is not dissolved but floats on the surface. This however is not an infallible test.

No. 6. *Ground nut oil.* (*Arachis hypogæa.*)

The Ground nut or "Manilla" nut, and the oil extracted therefrom, has of late years been exported to a considerable extent. It is now grown in all parts of the Peninsula. The oil is seldom used by the Natives, although large quantities of the nut are eaten after being slightly roasted over a charcoal fire. The cleaned seeds yield about 43 per cent. of a clear straw colored edible oil possessing a

slight bean-like taste and smell, which makes a good soap, indeed it is a perfect substitute for olive oil in all its uses.

Its value in London in January 1855 was £47-10 per ton. In North Arcot, where it is largely cultivated, the oil is procurable at from Rs. 1-8-0 to 2-12-0 per maund. In the Nellore district the seed costs 1-8-0 per maund, and in Tanjore about 200 acres are cultivated with this plant yielding annually 75 candies of oil at Rs. 2-6-0 per maund. In the year 1848-49, 37,000 gallons of this oil were shipped, but in the two following years the exports exceeded 1,00,000 gallons. It however fell to 75,207 gallons in 1852-3.

According to Simmonds, 1,950 parts of seed give 1,405 of blanched kernels and 703 of oil, by cold pressure. It is produced to a very large extent in Africa, from whence England and France draw large supplies.

No. 7. *Linseed oil.* (*Linum usitatissimum.*)

The seed from which this oil is expressed has long been cultivated to a limited extent at Nagpore, Bellary, Guntoor and other parts of the Presidency. It is usually sown in furrows on the borders of fields, and the extent of cultivation is consequently difficult to ascertain.

The oil is seldom used for painting in India perhaps from an impression which seems to be general, that the oil obtained from Indian seed is inferior to that imported from England. It will however be found on experiment, that this arises from the former having been imperfectly freed from the mucilage which prevents its drying, or from some admixture of a non-drying oil.

In the year 1852-3 English Linseed oil to the amount of gallons 4,552 valued at Rs. 8,763 was imported into Madras, whilst at the same time 1,045 cwt. of the seed was exported hence, mostly to England. The fact that it can be made on the spot equal in quality and considerably less in price than the English article, needs only to be known to be taken advantage of. It would be necessary to guard against its adulteration with any of the greasy oils, which would of course infallibly destroy its drying properties.

The value of this oil in England was from £61 to £66 in January 1856. It is said to be procurable in Bellary at Rs, 3-8-0 per

maund. It was imported into England in 1851 to the amount of 608,986 Quarters.

Some energetic efforts have been made to improve the cultivation of Linseed in the Punjab chiefly for the sake of fibre. The Agri-Horticultural Society having obtained a grant of money from Government offered rewards for its cultivation, and a considerable increase immediately took place.

In 1853-4 there were 3,435 acres under cultivation in eight districts, whereas in the next year no less than 19,039 acres were so taken up, and it is estimated that the whole cultivation throughout the Punjab during that season was 50,135 acres producing 146,508 mds. of fibre, and the increased produce of seed is estimated at 130,000 mds. valued at 160,000 Rs. The seed sold by auction at an average rate of Rs 4-6 per maund of 80lbs." (*Spectator, Oct.* 14, 1856.)

The following extract from a late number of the "*Sindian*" newspaper, will give some idea of the progress made in Linseed cultivation in Scinde.

"We are glad to observe that the growth of Linseed in Scinde is attracting the attention of the authorities. Major Wormald tried an experiment at Jemadar-ka-Landee, and gives a very favorable report, which has been placed by the Commissioner in Scinde at the disposal of the Press. We have seen a specimen of the Linseed, and the following is a description of its culture and growth.

"At Landee, the quantity of land prepared for seed was 4,658 square yards, on which was sown 126lbs. of Linseed, part on the 28th October, and the rest on the 1st November 1856. In four months the crop was pulled up and stacked; and the produce was one thousand pounds of Linseed, being as far as may be judged, much above the average yield of flax crops in different parts of Europe, and certainly finer Linseed than any yet seen here. A sample of this Linseed has been forwarded to Mr. Warwick, a merchant in Kurrachee, who pronounces it to be very fine. It is intended that the sample be forwarded to Bombay, when an opinion will be formed on it by competent judges.

" The stalks of this seed grew strong, and ranged from two to three feet No opportunity has as yet been afforded of converting the stems into flax, and as the stackage will not deteriorate from their quality, opportunity may be found to complete the experiment.

" Major Wormald, from past experience, considers the soil in the Mulleer Valley particularly suited for the growth of Linseed and Flax, and feels confident that if cultivated on a large scale a fortune might soon be realized.

" The ten-fold yielding of this valuable seed in the Mulleer valley, owing to rich soil, should operate as an inducement to the Commissioner to promote the growth of an article, that bids fair to make so respectable a figure in the revenue of the Province. The sample we have seen appears to possess the properties of the best kind. The seeds are small, bright, grayish-brown, slippery, elongated bodies, containing a full amount of that mealy, oleaginous albumen, which yields the oil in such abundance. In short we consider the specimen we have seen as well worthy the attention of those whose hearts are with the prosperity of Scinde."

No. 8. *Ramtill oil.* (*Verbesima sativa or Guizotia oleifera.*)

This sweet tasted edible oil is plentiful in the Mysore, Vizagapatam, Nagpore and Ganjam districts. It is used for nearly the same purposes as the Gingeley oil, and from its inferior quality and low price is frequently used to adulterate both this and Castor oil. It is exported from Ganjam.

The oil is said to mix with colors as well as linseed and to dry *without* litharge, although a little improves it.

No. 9. *Mustard oil.* (*Sinapis varieties.*) *Improperly called " Rape" in India.*

Five or six kinds of Sinapis are cultivated in various parts of Southern India. The seed is chiefly used as a condiment, but the oil which is sometimes extracted is much prized by the Natives, and apart from its edible qualities is supposed to possess many virtues. The different kinds of seed yield from 28 to 36 per cent. of a bright yellow edible oil, having a strong smell and a slight taste of mustard. The average price of Mustard seed in eighteen large stations, in all

parts of the Presidency for the quarter ending 31st October 1854, was Rs. 1-2-8 per maund of 25lbs., the maximum being Rs. 1-11-6 at Cannanore, and the minimum As. 10-6 at Nagpore. In Vizagapatam it costs Rs. 208 per sicca garce.

The oil is not exported, but the seeds have been annually shipped as follows:

Years	1847-8.	1848-9.	1849-50.	1850-1.	1851-2.	1853-4.	1854-5.
Cwt..	5,828	6,767	9,435	9,909	16,075	—	—

Although seldom procurable in the market, this oil is nevertheless generally made, and used in cooking and in the manufacture of pickles, condiments, &c. It is considered by the Natives superior to all other oils for anointing the body which it is supposed to invigorate.

In medicine it is sometimes given internally as a remedy for flatulent colic, but is more frequently applied as a rubefacient, and as a cure for burns and wounds.

Rape oil (*Brassica*) properly so called, was imported into England in 1851 to the amount of 107,029 Qrs. or 21,606 tons from France and Germany, the oil is valued at £34 per ton.

No. 10. *Poppy oil.* (*Papaver somniferum.*)

The Poppy is largely cultivated throughout Malwa and the Opium districts, where the drying oil obtained from the seed is more extensively used than any other, both in lamps and as food. The following statistics regarding the cultivation of the Poppy plant, are furnished by C. Timmins, Esq., Sehore.

"There are three lacs of beegahs under Poppy cultivation in Malwa, the average produce of seed per beegah being two maunds,*each of 40 seers, or 82lbs, which gives a total of 6,00,000 maunds of seed worth from Rs. 1 to $1\frac{3}{4}$ per maund. From these six lacs, deduct $1\frac{1}{4}$ seer per beegah required for seed, and there remains 5,90,623 maunds of seed for oil. The oil extracted from 1 maund of seed being about 13 seers, the above quantity of seed would yield a total of 1,91,952

* NOTE.—The seer in use here is more than three times the weight of the Madras seer. It weighs $32\frac{4}{5}$ ounces, that of Bombay being $11\frac{1}{5}$ oz., and Madras 10 ounces.

maunds of oil, which sells at from Rs. 4-8-0 to 5 Rs. per maund or £40-6 per ton. The whole of the oil at present made here appears to be consumed in Malwa. Mr. Anson, the first Assistant to the Governor General and Superintendent of the Opium department at Indore, concludes that 5,000 maunds might be available for export at Indore alone.

"The hire of a cart from Indore to Bombay would be about 20 or 25 Rupees. The carts are much smaller than those used in the Madras territory, and will carry from 20 to 24 maunds. There would appear to be no difficulty in establishing an export of this oil, provided there were a remunerating demand for it; the extent of supply must however be regulated by the demand for Opium, the high price obtainable for which alone supports this expensive and hazardous cultivation.

"Perhaps Calcutta presents greater facilities for the export of the seed or oil from the advantage of the water carriage afforded by the Ganges and other rivers of Bengal; but the railway now progressing from Bombay will materially facilitate the transit of goods from this part of India, but as before remarked the production of Poppy oil must ever be dependent on the demand for opium which may possibly be extensively affected by the extraordinary revolution now progressing in China.

By simple exposure to the rays of the sun, in shallow vessels, this oil is rendered perfectly colorless. It is supposed by the Natives to produce sleep and strengthen the brain. Poppy oil is peculiarly suitable for mixing with paints; "with white lead it leaves a beautiful surface which does not afterwards change by the action of light into a dirty yellow."

Class 2.

No. 11. *Margosa or Neem oil.* (*Azadirachta Indica* and *Melia azadirach.*

Two species of the Neem grow in Southern India. The Azadirachta Indica, or white flowered Neem, is exceedingly graceful, and forms an excellent avenue tree. The Melia azadirach or Per-

sian lilac, is a tall wide-spreading tree, of quick growth, the branches of which are very brittle and liable to be broken in high winds. The blossoms are of a lilac color, possessing a very sweet smell, and the fruits as well as the extracted oil of both varieties are much alike.

A bitter principle prevails in all parts of the tree, and is present in the oil, which is much used by Native practitioners as an anthelmintic and vermifuge, and externally as a liniment in rheumatism, headache, &c. it is of a deep yellow color, unpleasant smell, and bitter taste ; it forms an article of export, although the demand fluctuates considerably. Besides the uses above mentioned, it is also burnt in lamps, and is known in the market by the name of the "bitter oil."

No. 12. *Illoopoo and Mahowa oils.* (*Bassia longifolia et species.*)

Several varieties of the *Bassia* yield semi-solid oils known by these names. The *B: longifolia* is the most common in Southern India, and although the oil is seldom to be met with in the bazaar, yet large quantities of the seeds are gathered, and the oil extracted for private consumption. Excellent candles and soap may be made from it, and as a substitute for butter and for burning in lamps, it is much employed by the poorer classes. It is sometimes exported in small quantities.

The *Bassia butyracea* is abundant in the hills of Kumaon, and produces an oil known by the names of Fulwah, Phulwarah, Chooree fooliel and Phooliel ka tael. This solid oil dissolves readily in alcohol, and is said to keep an indefinite time without becoming rancid.

No. 13. *Pinnacotay oil.* (*Calophyllum inophyllum.*)

The fresh seeds of the "Alexandrian laurel" when shelled and subjected to pressure, yield a dark green oil of a peculiar odour. Old seeds yield a higher colored and thicker product. It is occasionally shipped in small quantities to Ceylon, but cannot be considered a regular article of export. It is burnt in lamps.

No. 14. *Kurunj oil.* (*Dalbergia arborea.*)

This oil, which in some parts of the country is used to a large extent in adulterating lamp oil, is expressed from the seeds of a

tree common in most parts of India. Its fluidity at ordinary (Indian) temperatures renders it very suitable for burning in lamps, whilst its comparative cheapness leads to its use as an adulteration with other more expensive oils.

No. 15. *Coorookoo or Brumadundoo oil.* (*Argemone mexicana.*)

This pale yellow limpid oil may be obtained from the round corrugated seeds of the "prickly poppy" which was originally introduced from Mexico in ballast, but now flourishes luxuriantly in all parts of Southern India. It is especially suited for lamps, and is also employed in the process dying red thread, and as an external application in cutaneous diseases. The seeds yield 12½ per cent. of oil.

W. Hamilton, Esq. M. D. remarks of this oil, "that the Materia Medica hardly presents a more valuable purgative, or one which answers so many apparently conflicting circumstances at one and the same time. In that excruciating complaint, so common in all climates, colic arising from constipation of the bowels, 30 drops of the oil taken upon a lump of sugar allay the pain as if by magic, throw the patient into a profound sleep, and after a little time produces a copious and unpainful evacuation of the bowels. The minuteness of the requisite dose, the instantaneousness of the relief, and the mild and gentle though effectual action it produces upon the intestinal canal, seem peculiarly to adapt it for cases of Cholera, superseding the use of Chloroform and Opium for subduing the cramps and mitigating the more urgent symptoms."

No. 16. *Cât amunak oil.* (*Curcas purgans.*)

This oil has of late been exported to Europe as a substitute for Linseed oil, but the results of the experiment have not as yet transpired. The shrub is plentiful all over the Presidency, and the oil can be obtained in some parts of the country for little more than the expense of the collection of the seeds and cost of extraction. It is used by the Natives in lamps, &c.

"Under the name of "seed oil" it has been imported into England to the amount of nearly 1000 tons per annum from Lisbon, where it was first used by the contractor in lighting the public streets, and so useful was it found, that it soon usurped the place of all other oils. It has been found to answer in England for cloth dressing,

which in consequence of the irregular supply of olive oil makes it a valuable acquisition, the only objection to its employment being its highly drastic property." (*Simmonds.*)

No. 17. *Piney tallow.* (*Vateria Indica.*)

The *Vateria Indica* or Doopada tree, grows plentifully in the jungles of the western coasts, and besides the product under consideration yields a resin nearly equal to copal, and a valuable building wood. The oil which is perfectly solid even in hot climates, is prepared by cleaning the seeds, then roasting and grinding them into a mass. To five seers of seed 12 seers of water are added, and the whole is boiled until the oil rises to the surface. Remove the oil, stir the contents of the vessel and allow it to stand until the following day, when a further portion of oil will be found on the surface.

This substance has been pronounced by the Railway Agent very suitable for the lubrication of the wheels and axles of Railway carriages, it is not however at present procurable in sufficient quantity to be used for that purpose, except to order. It is equally applicable to the manufacture of soap and candles. The next mentioned oil is very similar in quality to the above.

No. 18. *Gamboge Butter.* (*Garcinia pictoria.*)

A semi solid oil obtained from the seeds of the Garcinia pictoria, growing abundantly in certain parts of Mysore and in the Western coast jungles, especially near Cooly Droog. The oil which is procurable in moderate quantities, is prepared by pounding the seed in a stone mortar, and boiling the mass until the butter or oil rises to the surface; or by first roasting the seeds, and then proceeding as above. Two and a half measures of seed should yield one and a half seers of butter.

In the Nugger division of Mysore it is sold at the rate of As. 1-4 per seer of 24 Rs. weight, or £36-6 per ton, it is used as a lamp oil, and by the poorer classes as a substitue for ghee. The butter thus prepared does not seem to possess any of the purgative properties of the Gamboge resin.

CLASS 3.

No. 19. *Safflower oil.* (*Carthamus tinctorius.*)

The Carthamus is principally grown for the sake of the dye yielded by the petals of the flower, oil is however plentiful in the seeds and is expressed to a small extent. In Europe it is in demand for the manufacture of fancy soaps, &c. It grows plentifully in black cotton soil in Mysore and Tinnevelly. The oil which is of a clear yellow color, is edible.

No. 20. *Belgaum Walnut oil.* (*Aleurites triloba.*)

The tree which produces the Lumbang or "candle nut" grows plentifully in Hyderabad, Mysore and other parts, also in Ceylon where the oil is called "Kekune," and in the Sandwich Islands where it is named "Kickui." (*Simmonds.*)

The tree is very prolific, and the nuts yield so large a per-centage of oil, that when strung upon a thin strip of bamboo and lighted, they burn like a candle. (*Riddle.*)

No. 21. *Poovana oil.* (*Sarcostigma Kleinii.*)

This oil is as yet known only in Tinnevelly, Travancore and the Western coast. It has a very peculiar but not disagreeable odour, is burnt in lamps, and sold in the Tencausy talook of Tinnevelly, at Rs. 4 per maund. It is known in Travancore under the name of Poovengah.

No. 22. *Neeradimootoo oil.* (*Hydnocarpus inebrians.*)

This tree is produced abundantly in Travancore, and is met with on the Eastern side of the Ghats, especially near Shencotta at the entrance to the pass leading to Quilon. The oil is also known under the various names of Jungle almond, Maroty, Tamana, Maravettie, Neervittie and Soorty. It is in great repute amongst Native medical practitioners, and the oil appears somewhat drastic. The kernel has much the taste of the Brazil nut, and the shell, although differing from it in other particulars, has the same corrugated surface. It might probably be found very useful in the arts, as it much resembles Almond oil, but is much thicker. The seed yields 44 per cent. of oil, and cost As. 2-6 per seer at Madras.

No. 23. *Addale oil.* (*Jatropha glauca.*)

This seed is somewhat smaller than that of the *ricinus*, which however it much resembles. It grows wild on waste lands in South Arcot, and is cultivated in Tinnevelly, where the oil sells at Rs. 2-8 per maund. It is limpid, of a light straw color, and if procurable in sufficient quantities, would prove a very serviceable lamp oil.

No. 24. *Cress seed oil.* (*Lepidium sativum.*)

The Tamil name of the seeds of this plant, is the same as that of the Linseed, probably from its being like it of a mucilagenous nature. Its qualities and uses have yet to be ascertained.

25. *Cheeronjee oil.* (*Chirongia sapida vel Buchanania latifolia.*)

The kernels of this nut mixed with milk are eaten by the higher classes of Natives to promote fatness. They abound in a straw-colored, sweet tasted and limpid oil, which, although edible, is seldom extracted. The tree grows plentifully in Mysore, Cuddapah and other parts. Dr. Riddle states the method of separating the kernel from its shell to be as follows:

"The fruit, when ripe in May, is gathered and soaked in water to soften the outer pulp which is then rubbed off by the hand. The little nut, after being dried in the sun, is broken between a common 'chuckee' or mill, such as is used for grinding wheat, it is then shifted and winnowed."

No. 26. *Cucumber seed oil.* (*Cucumis sativa.*)

No. 27. *Melon seed oil.* (*Cucumis melo.*)

No. 28. *Pumpkin seed oil.* (*Cucurbita pepo.*)

The various species of the Cucurbitaceæ are extensively cultivated in the dry beds of rivers, or on sand banks in their vicinity, in all parts of India. The seed is sown in the hot weather, and the fruit perfected before the rains. Oil is made from the seeds in the Masulipatam and Guntoor districts, but the bulk of the fruit is sold and eaten before it arrives at maturity.

No. 29. *Coorgapilly oil.* (*Inga dulcis.*)

The "Manilla tamarind" is extensivly used in all parts of the

Presidency as a hedge plant. If permitted however, it grows to a small sized tree, the pods of which contain several flattened black seeds, from which an oil of the consistence of castor oil may be extracted.

No. 30. *Sterculia oil.* (*Sterculia fetida.*)

The seeds of this forest tree yield by expression a clear oil containing much stearine.

No. 31. *Wild Olive oil.* (*Pootrunjiva Roxburghii.*)

This tree grows plentifully in Mysore and Canara, the fruit much resembles an Olive, and the kernel contains an olive brown oil.

No. 32. *Cherroo Pinnacotay oil.* (*Calophyllum colaba.*)

A clear yellow oil obtained from this tree was forwarded to the Madras Exhibition of 1855 from Cochin.

No. 33. *Sandal seed oil.* (*Santalum album.*)

The kernel of the nut of the Sandal wood tree, yields by expression, a viscid oil, which does not give much promise of usefulness.

No. 34. *Moorgana tallow.* (?)

This valuable substance, which, even at high temperatures, is perhaps the most solid oil with which we are acquainted, is produced in Canara. If procurable in sufficient quantity and at a moderate cost, it would be doubtless an excellent material for the manufacture of candles, &c.

On the Western coast it is used medicinally as a cure for cattle wounded by tigers.

No. 35. *Naga sumpaghee oil.* (*Mesua ferrea.*)

This oil is procurable in Canara, at Rs. 4 per maund. It is chiefly used as a Lamp oil, and as a healing application to sores.

No. 36. *Câtt urraloo oil.* (?)

An oblong, flattened and corrugated seed sent from Canara under the names of "Wild Castor seed" has not yet been identified. It yields a lamp oil.

CLASS 4.

No. 37. *Soapnut oil.* (*Sapindus emarginatus.*)

This oil is extracted from the kernels of the seed, and is used medicinally.

No. 38. *Cashew nut oil.* (*Anacardium occidentale.*)

The nuts of this tree yield by expression a very sweet tasted edible oil, much superior to European Olive oil, but not so cheap as the Ground nut oil. The nuts however being generally roasted and eaten, the oil is seldom expressed.

No. 39. *Ben nut oil.* (*Moringa pterygosperma.*)

This oil has long been considered valuable on account of the long period which it may be kept without contracting rancidity. This quality, as well as the very low temperature required to freeze it, renders it exceedingly useful to the watch maker and perfumer.

The tree grows in all parts of the country, and flowers at all seasons, the blossoms, green and ripe fruit being often seen on the same tree at the same time. The young leaves and green legumes are eaten both by Natives and Europeans, and the rasped root forms an excellent substitute for horse-radish, to which circumstance it owes its common name of " horse-radish tree." The oil is seldom manufactured in India.

No. 40. *Cotton seed oil.* (*Gossypium species.*)

The seeds of the various varieties of Gossypium contain a large proportion of oil, but the remains of the fibre adhere with such tenacity to the seed of almost all the varieties at present generally cultivated in India, that it is found to absorb the whole of the oil expressed, from which it cannot be separated without much difficulty. The oil is consequently never made in India, although the seed is a nourishing food for cattle. Should however, any of the varieties of Cotton with loose seeds, such as the *G. acuminatum* come into general cultivation, the oil would then become of much importance.

At present this oil is manufactured at Marsellies from seed imported from Africa, and could some cheap and easy method of ridding the ordinary cotton seed from the adherent fibre be de-

vised, thousands of maunds of seed which are now comparatively useless, could be worked up.

No. 41. *Silk Cotton seed oil.* (*Bombax.*)

A dark brown but clear oil, is obtained by expression from the seeds of the silk cotton tree, the pappus of which is sometimes used as a stuffing for pillows, although it is by some supposed to produce deafness.

No. 42. *Sweet Fennel oil.* (*Nigella sativa.*)

The black aromatic seeds generally known by the name of "Siah Danah" yield by expression a dark colored fragrant oil.

No. 43. *Rosebay oil.* (*Wrightia antidysenterica.*)

Various parts of this plant are reputed to possess medicinal virtues. The oil obtained by expression from the seeds, is of a deep red color and viscid consistence, probably possessing some of the medicinal properties of the seed.

No. 44. *Malkungunee oil.* (*Celastrvs paniculata.*)

The oil expressed from the seeds of this shrub is of a bright scarlet color, and when mixed with other ingredients and subjected to destructive distillation, yields an empyreumatic product useful in Beri-beri.

No. 45. *Hemp seed oil.* (*Cannabis sativa.*)

Obtained by expression from the seed of the common hemp which is cultivated in several parts of the country for the sake of the intoxicating drugs it yields. In Russia the oil is much used for lamps but it is comparatively unknown to the Natives of India.

No. 46. *Portia nut oil.* (*Thespesia populnea.*)

From 8 to 10 per'cent. of a deep red and somewhat thick oil is obtained by expression from the seeds of this tree, which grows in great abundance in the vicinity of Madras and other parts of the Presidency. It is extensively planted as an avenue tree for which its quick growth and the beauty of its flowers render it a general favorite, it is however very liable to injury from high winds (as may

be seen on reference to the Journal of the *Madras Literary Society. No. 1. New Series.*) The greater injury almost invariably suffered by trees grown from cuttings, has been frequently remarked. The wood is said to be capable of being worked, when fresh cut. The juice is used on the western coast as a remedy for various cutaneous affections.

No. 47. *Viscid Cleome oil.* (*Cleome viscosa.*)*

This warm and pungent little seed when subjected to a very powerful pressure, yields 13 per cent. of a light olive, green limpid oil.

No. 48. *Thortay oil.* (?)

Is obtainable in small quantities in Canara, it is a solid oil and used as a native remedy for sores.

No. 49. *Fœnugreck oil.* (*Trigonella fœnum græcum.*)

The fresh seeds of this plant are said to yield a small per-centage of oil.

No. 50. *Abelmoschus oil.* (*Abelmoschus ficulneus.*)

In addition to its fibre, for which the plant is used, the seeds yield a small quantity of oil.

No. 51. *Gutta percha seed oil.* (*Isonandra gutta.*)

Yielded by expression. Oil but little known.

No. 52. *Croton oil.* (*Croton tiglium.*)

This well-known medicinal oil, the use of which as a drastic purgative appears to be on the decline, is seldom extracted in India, the powdered seed, being usually administered by native practitioners. It is also used in veterinary medicine.

Nos. 53 and 54. *Bryony and Colocynth oils.*

These plants grow wild in most parts of the country. The seeds are collected by shepherd boys, and boiled to obtain the oil, which is only used for lighting purposes.

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* Now *Polanisia icosandra, W. and A.*—Ed.

No. 55. *Wild Cummin oil.* (*Vernonia anthelmintica.*)

This black seed grows plentifully in Mysore, and yields an oil, which however is never prepared for sale.

The following oils being used only in Native medicine, an enumeration of their names will be sufficient.

No. 56. *Bonduc nut oil.* (*Guilandina bonduc.*)

No. 57. *Mimusops oil.* (*Mimusops elengi.*)

No. 58. *Moodooga oil.* (*Butea frondosa.*)

No. 59. *Thevetia oil.* (*Thevetia neriifolia.*)

No. 60. *Oodul oil.* (*Sarcostigma Kleinii.*)

No. 61. *Garlic oil.* (*Allium sativum.*)

No. 62. *Sunflower oil.* (*Helianthus annuus.*)

No. 63. *Wild almond oil.* (*Terminalia catappa.*)

No. 64. *Star anise oil.* (*Illicium anisatum.*)

No. 65. *Gayapa oil.* ——————— ?

No. 66. *Wild nutmeg oil.* (*Myristica malabarica.*)

No. 67. *Thorny trichilia oil.* (*Trichilia spinosa.*) Empyreumatic.

No. 68. *Cyperus or Mat grass oil.* (*Cyperus juncifolius.*)

No. 69. *Thorn apple oil.* (*Datura stramonium.*) Empyreumatic.

No. 70. *Condamunnee oil.* (*Abrus precatorius.*)

No. 71. *Sand box tree oil.* *Hura crepîtans.* The seeds of this tree (which has been introduced from Jamaica,) yield by expression, a clear oil. The whole tree, abounds in poisonous matter, but it has not yet been ascertained whether the oil possesses similar properties, the tree grows in the Horticultural gardens.

No. 72. *Saul seed oil.* (*Shorea robusta.*)

In places where this tree abounds, the oil is expressed from the ripe seed, vulgarly called the "dammer tree nut."

WOOD OILS.

91 *to* 100. *Wood oils.*

The class of substances called "Wood oils" form the connecting link between the oils and resins of the natural kingdom. They consist of a volatile oil, holding in solution a resin, and are generally classed under the head of Balsams. They are obtained from various trees of the order Dipterocarpeæ, some of which also yield the dammers of commerce.

The mode of extracting the oil, is similar to that adopted for obtaining the solid resin. It is best described, in the words of a contributor to the Madras Exhibition of 1855, who says "About the end of the dry season, that is in March or April, several deep incisions are made with an axe into the trunk of the tree, and a good sized piece, scooped out. Into these holes, fire is placed and kept burning until the oil begins to run, when it is received into a bamboo, and allowed to run slowly drop by drop."

The oil, when freshly obtained from the tree and allowed to rest, separates into two layers, the upper consisting of a clear chesnut colored liquid balsam, and the lower being a flocculent deposit of the more solid resin, of a light ash color.

They are much used as natural varnishes for in-door work, but are very brittle, and require constant renewal. Perhaps the admixture of a certain proportion of some drying oil, would remedy this defect. They are said to be used also in the manufacture of Lithographic inks.

These oils are chiefly imported from our Burmese possessions and the Islands in the Straits of Malacca, and are usually known by the name of the districts, from whence they are brought.

The Camphor wood oil is a purely volatile substance, without any admixture of resin. It is the produce of the *Dryobalanops Camphora*. It is used in the Straits as a substitute for turpentine, and sells at 15 to 20 cents a bottle.

Many substances called „ wood oil" by Native doctors, are little else than varieties of tar obtained by the destructive distillation

of chips of various woods. For the names of these see Index to Section 3.

MINERAL OIL.

101 *Petroleum or naptha.*

Naphtha is a limpid colorless oil, which is collected in wells, or pits dug into certain clay soils in Media and Persia. It is also found in the European state of Parma, and is used to illuminate the city of Genoa.

A substance similar to this product is obtained during the process of making coal gas, and is called coal naphtha. It is a solvent of India rubber and is extensively used in the arts.

Petroleum is a more solid product, produced largely in our Burmese possessions near Rainanghong. It is burnt in lamps, and used instead of tar for shipping.

ANIMAL OILS.

102 *and* 103. *Fish oils.*

The only oil of any importance which comes under the head of animal oils, is fish oil, which is largely prepared on the Western Coast. For the mode of preparation, see " *Jury Reports Madras Exhibition of* 1855, page 39.

104 *and* 105. *Neats foot oil* and *oil of wax.*

These two oils are seldom prepared, the former is, however, sometimes used for softening leather, and the latter, which is an empyreumatic product, obtained by the destructive distillation of wax, is used in Native medicine.

VOLATILE AND PERFUMED OILS.

106 to 133.

Of these the only oils, made in any quantity, are those of Lemon grass, Roosa grass, Citronelle, Bishopsweed, Cinnamon, Cassia bark and Cajeput. Their properties and uses are well known. A list of the oils, in this class which are sometimes used to a small extent in Native medicine, will be found in the Index. The oil from the Guava leaf is said to be used in Ceylon.

The exports of Citronelle oil, from Ceylon are as follows :

1850	86,048oz.	£3,344
1851	114,959oz.	£5,742
1852	131,780oz.	£2,806

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VEGETABLE FIXED OILS.

Class	Oil	Botanical name
CLASS. 1.	1 Cocoanut oil.	Cocos nucifera.
	2 Gingeley oil.	Sesamum orientale.
	3 Bastard gingeley oil.	Sesamum orientale. variety.
	4 Lamp oil.	Ricinus communis. fr. maj :
	5 Castor oil.	Ricinus communis. fr. min.
	6 Ground nut oil.	Arachis hypogæa.
	7 Linseed oil.	Linum usitatissimum.
	8 Ramtill oil.	Guizotia oleifera.
	9 Mustard or "rape" oil.	Sinapis species.
	10 Poppy oil.	Papaver somniferum.
CLASS 2.	11 Margosa or Neem oil.	Melia azadirach, and Azadirachta Indica.
	12 Illoopoo and Mahowa oils.	Bassia species.
	13 Pinnacotay oil.	Calophyllum inophyllum.
	14 Kurunj oil.	Dalbergia arborea.†
	15 Coorookoo or Brumadundoo oil.	Argemone Mexicana.
	16 Cât amunak oil.	Curcas purgans.
	17 Piney tallow.	Vateria Indica.
	18 Gamboge butter.	Garcinia pictoria.
CLASS. 3.	19 Safflower oil.	Carthamus tinctorius.
	20 Belgaum walnut oil.	Aleurites triloba.
	21 Poovana oil.	——————— ?
	22 Neeradimootoo oil.	Hydnocarpus inebrians.
	23 Addale oil.	Jatropha glauca.
	24 Cress seed oil.	Lepidium sativum
	25 Chironjee oil.	Chirongia sapida.*
	26 Cucumber seed oil.	Cucumis sativus.
	27 Melon seed oil.	——— melo.
	28 Pumpkin seed oil.	Cucurbita citrullus.
	29 Coorkapilly oil.	Inga dulcis.
	30 Sterculia oil.	Sterculia fetida.
	31 Wild olive oil.	Putranjiva Roxburghii.
	32 Cherroo pinnacotay oil.	Calophyllum calaba.
	33 Sandal seed oil.	Santalum album.
	34 Mooroogana tallow.	———————
	35 Naga sumpaghee oil.	Mesua ferrea.
	36 Cât urraloo oil.	Jatropha.———

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* Now *Buchanania latifolia, W. and A.*—ED.

† *Pongamia glabra, W. and A.*—ED.

Class. 4.	37 Soap nut oil.	Sapindus emarginatus.
	38 Cashew nut oil.	Anacardium occidentale.
	39 Ben nut oil.	Moringa pterygosperma.
	40 Cotton seed oil.	Gossypium sp.
	41 Silk cotton seed oil.	Bombax malabarica.
	42 Fennel flower oil.	Nigella sativa.
	43 Rosebay oil.	Wrightea antidysenterica.
	44 Malkungunee oil.	Celastrus paniculata.
	45 Hemp seed oil.	Cannabis sativa.
	46 Portia seed oil.	Hibiscus populneus.*
	47 Viscid cleome oil.	Cleome viscosa.
	48 Thortay oil.	———
	49 Fœnugreck oil.	Trigonella fœnum græcum.
	50 Abelmoschus seed oil.	Abelmoschus ficulneus.
	51 Gutta percha seed oil.	Isonandra gutta.
	52 Croton oil.	Croton tiglium.
	53 Bryony oil.	Bryonia callosa.
	54 Colocynth oil.	Cucumis colocynthis.
	55 Wild cummin oil.	Vernonia anthelmintica.
	56 Bonduc nut oil.	Guilandina bonduc.
	57 Mimusops oil.	Mimusops elengi.
	58 Moodooga oil.	Butea frondosa.
	59 Thevetia oil.	Thevetia neriifolia.
	60 Oodul oil.	Sarcostigma Kleinii.
	61 Garlic oil.	Allium sativum.
	62 Sunflower oil.	Helianthus annuus.
	63 Wild almond oil.	Terminalia catappa.
	64 Star anise oil.	Illicium anisatum.
	65 Gayapa oil.	Swietenia ??
	66 Nutmeg (wild) oil.	Myristica malabarica.
	67 Thorny trichilia oil.	Trichilia spinosa.
	68 Cyperus bulb oil.	Cyperus juncifolius.
	69 Thorn apple oil.	Datura stramonium
	70 Condamunnee seed oil,	Abrus precatorius.
	71 Sand-box seed oil.	Hura crepitans
	72 Saul seed oil.	Shorea robusta.
	73 Eugenia oil.	Eugenia.
	74 Belleric myrabolan oil.	Terminalia bellerica.
	75 Chebulic. do. oil.	Terminalia chebula.
	76 Kikuel oil.	Bergera kœnigii
	77 Balanites Ægyytiaca oil.	Balanites Ægyptiaca.
	78 Radish seed oil.	Raphanus sativus.
	79 Cabbage seed oil.	Brassica oleracea.
	80 Cardamom oil (fixed.)	Elettaria cardamomum.
	81 Poondy oil.	———
	82 Cordia or Nochie oil.	Sebestana officinalis.
	83 Girghitly oil.	———
	84 Jogyhulloo oil.	———
	85 Nux vomica oil.	Srychnos nux vomica.
	86 Marking nut oil.	Semecarpus anacardium.
	87 Cashew husk oil.	Anacardium occidentale.
	88 Oleum nigrum oil.	Celastrus &c.
	89 Tobacco seed oil.	Nicotiana tabacum.
	90 Alligator pear oil.	Persea gratissima
	90½ Cinnamon tallow.	Cinnamomum Zeylanicum.

* Now *Thespesia populnea.*—Ed.

Class	No.	Oil	Source
		WOOD OILS.	
CLASS. 2.	91	Teakwood oil.	Tectona grandis.
	92	Wood oil from Pegu.	Dipterocarpus alatus.
	93	do. Rangoon.	do. ——— ?
	94	do. Chittagong.	do. ——— ?
	95	do. Moulmein.	do. ——— ?
	96	Shemanathee wood oil.	Seth ia indica.
	97	Sissoo wood oil.	Dalbergia sissoo.
	98	Camphor wood oil.	Dryobalanops camphora.
	99	Wood oil.	——— ———
	100	Wood oil.	——— ———
		MINERAL OIL.	
CLASS, 1.	101	Petroleum and Naptha.	
		ANIMAL OILS.	
	102	Fish oil.	
	103	Fish liver oil.	
CLASS, 2.	104	Neats foot oil.	
	105	Oil of wax.	
		VOLATILE AND PERFUMED OILS.	
CLASS, 1.	106	Cinnamon bark oil.	Cinnamomum Zeylanicum.
	107	Cinnamon leaf oil.	do.
	108	Cassia oil.	Cinnamomum cassia.
	109	Clove oil.	Caryophyllus aromaticus.
CLASS. 2.	110	Lemon grass oil.	Andropogon schœnanthus
	111	Roosa grass oil.	Andropogon iwarancusa.
	112	Cajeput oil.	Melaleuca cajaputi.
	113	Camphor tree oil.	Dryobalanops camphora.
CLASS. 4.	114	Anise seed oil.	Pimpinella anisum.
	115	Fennel flower oil	Nigella sativa
	116	Nutmeg (wild) oil.	Myristica malabarica.
	117	Sassafras oil.	Sassafras officinale.
	118	Bishop's weed or omum oil.	Ptychotis ajowan.
	119	Cardamom oil.	Elettaria cardamomum.
	120	Cummin seed oil.	Cuminum cyminum.
	121	Spikenard or jatamansi oil.	Valeriana jatamansi.
	122	Cuscus root oil.	Anatherum muricatum.
	123	Tobacco leaf oil.	Nicotiana tabacum.
	124	Sweet flag oil.	Acorus calamus.
	125	Pepper oil.	Piper nigrum.
	126	Cubebs oil.	Piper cubeba.
	127	Lime peel. and leaf oil.	Citrus limonum.
	128	Orange flower, or neroli oil.	Citrus aurantium.
	129	Orange peel, and leaf oil.	do.
	130	Citron peel, and leaf oil.	Citrus medica.
	131	Mustard oil (volatile.)	Sinapis species.
	132	Sandal wood oil.	Santalum album.
	133	Guava leaf oil.	Psidium pyriferum.

N. B.—This list is not to be taken as by any means including the whole of our indigenous oil plants.

SECTION IV.

REMARKS ON THE ECONOMICAL USES OF OILS IN INDIA.

The value of the *commercial* oils of India, being already so generally known to Merchants and Manufacturers, both at home and in this country, any remarks on this head would be superfluous ; it remains, however, to consider in what ways, we may become the *consumers* as well as the *exporters* of oils.

I would more particularly refer to their uses in the raw state for currying leather and making buff, for burning in lamps, for lubricating machinery, for anointing the person, and as an article of food,—to their value in a somewhat modified form, as a vehicle for paints, and varnishes,—and lastly to their employment in the manufacture of candles and soap.

Oil—as used for currying and buffing leather.—Experience has shown that the kinds of oil most suited for the preparation of leather, are those derived from the animal kingdom. Of these, fish oil, neats foot oil, and the solid fats of oxen, sheep and pigs, are those most generally used. Some one of these, or a mixture of several of them as the case may be, is rubbed over the underside of the tanned skin whilst still wet. The leather being then hung up in an airy loft to dry, the evaporation of the moisture enables the composition to penetrate through the substance of the hide until it appears on the surface or grain side. The beef, mutton and pigs fat used in this process are procurable with difficulty and at high prices.

At present, but little leather is curried in India, and the demand for these substances is consequently limited, but should this branch of trade rise into importance (of which there can be no reasonable doubt,) and should hides be tanned and finished on the spot, instead of being sent to Europe in the raw state, and re-imported when dressed, the supply of these substances will become of greater moment, and it will be a question for the practical manufacturer to decide, whether it is more to his interest to pay the current Indian prices, or to import his materials direct from Australia.

Fish oil, however, is procurable in abundance at reasonable prices,

indeed, the Indian article has entirely superseded the use of English oil, which, until the establishment of this manufacture on the Western coast, was imported at a high price for the use of the Government Buffing establishment at Hoonsoor.

A comparison of the price of the Indian and English article is shown below, and as regards quality, it has been found that the Native oil, if made with care, is fully equal to the English product.

Cost of English oil per gallon	Rs.	2	4	0
Cost of Malabar oil per gallon	Rs.	1	10	0

The saving thus effected in this one article alone, in this large establishment, is very great.

Oil—as used for burning in lamps.—Almost all the oils procurable in India, are burned to a greater or less extent by the native population in the rude contrivances which serve as lamps. For the finer description of European lamps, however, only the fluid non-drying oils should be used. Of these Cocoanut, Ground nut, Coorookoo, Kurunj, and a few others are to be preferred. The first is decidedly the best, but in cold climates, it requires to be mixed with a due proportion of some other oil to prevent its tendency to congeal at low temperatures. Drying oils, such as Castor, Lamp, and Linseed oil are unsuitable for these lamps, as the oil becoming viscid, clogs the tubes; they may, however, in common with many other sorts of oil, be burned with advantage in open vessels or night lamps. Some of them emit much smoke.

In the preparation of these oils for burning in lamps, much improvement might be effected. Excepting Cocoanut, the generality of oils as sold in the market, are contaminated with mucilage and extraneous substances, which much impair their burning qualities.

The usual mode of purifying oil, is to add to 100 parts of oil one part of Sulphuric acid, and agitate the mixture; the acid immediately attacks and chars the slimy parts of the oil. In half an hour add 50 parts of water with agitation, and allow the whole to settle for some days. Decant the clear oil, and wash with water to get rid of the acid. The same object may be effected in a less degree by keeping the oil for some time in a quiet place, this improves it by

allowing the mucilage to subside ; for this reason, old oil is preferable to new for lamps. The manufacture of oil gas for illuminating purposes must not be passed over in silence. Oil dropped on a red hot surface is instantly converted into gas, (oil gas) and with the aid of very simple machinery, can be made by the most inexperienced person. It was at one time made to some extent in England, but the high cost of the oil and other causes, led to its abandonment in favor of coal gas.

Oil,—as a lubricating agent.—Any of the fluid non-drying oils, may be used as lubricants for machinery. For fine work, the Ben oil (Hyperanthera moringa) being free from any disposition to rancidity, is to be preferred, but for Railway carriages, a more solid substance, such as Piney tallow or Gamboge butter is more suitable. At present, however, a composition prepared by agitating lamp oil with nitric acid, for which the maker holds a patent, is employed successfully. The Gamboge butter, has been reported on favorably, by the Railway agent, as " very clear and free from grit, and suitable for lubricating axles." A more extended experiment with this substance is in contemplation. A locomotive engine is said to consume between eighty and one hundred gallons annually. A mixture of grease and tar is used for Native carts.

Oil—for anointing the person.—As an application for rendering the skin supple, which in tropical climates, is an almost indispensible necessary of life, any of the greasy oils will answer. Those generally preferred by the natives are Cocoanut, Gingeley, and Mustard oils. The former has been sometimes used by the European perfumer in the manufacture of scented oils for the hair, but the difficulty of preventing its acquiring the well known disagreeable odour, or of disguising it with the most powerful scents, is the chief objection to its use. The Moringa or Ben oil, from the great length of time, it keeps without acquiring rancidity, is well suited to the perfumer's use.

Oils—as articles of food. Oil is largely used as an article of food in all tropical countries, and as the qualities of most edible oils are well known, little need be added on this head further than to recommend greater cleanliness in the expression, and a more profitable use of the oil cake ; which, however, valuable as a manure is

still more useful for fattening cattle. As an ingredient in salads and similar dishes, for which it is used to a limited extent by Europeans in India, there is every reason to hope, that the native product, will ere long entirely supersede the imported article. Numerous indigenous plants such as the Poppy, Mustard, Gingeley, Ground nut, Chironjie, Cucumber, Cashew nut, &c. yield oils fully equal to the best product of Italy, with the advantage of superior freshness. Indeed, they are even now frequently used in preference to the English oil, and the only bar to their general adoption, is the difficulty of getting them extracted, in a pure state by the native press.

It is a well known fact, that a large portion of the oil prepared from seeds yearly exported from India, is consumed as " salad oil" in Europe, and part finds its way back to India, under the same name, although the fresh product is procurable on the spot, at a tenth part of the price of the re-imported article. The amount of Salad oil imported at Madras during two years was as follows:

In 1849-50, Galls. 268, value Rs. 1,139.

In 1850-51, Galls. 399, value Rs. 1,809.

The imports of Olive oil into England in 1851 amounted to 20,783 tons of 252 gallons each.

Oil,—as used in the preparation of woollen cloths, &c.—As a dressing for woollen cloth, oil is seldom if ever used in India, nor indeed is it probable that it ever will be, many of the indigenous oils, are however well suited for this purpose.

Oil,—as a vehicle for paints, varnishes, &c.—Poppy and Linseed oils, are in general repute in Europe for paints and varnishes. The former may be cheaply prepared in the opium districts of India, and from its perfect clearness and limpidity (when bleached) it is most valuable to the portrait and miniature painter, whilst the price at which it can be made renders it available for more common descriptions of work. From the fact, of no vegetable oils, (except wood oils,) being used as ingredients in paints by the Natives of India, it has not yet been ascertained which of the many varieties procurable in various parts are useful for this purpose.

Linseed, as will be seen on reference, to the first part of this

port, is now becoming a large article of produce and export trade, the oil however still continues to be imported from England, for the public service and private use. Trials have been made of the relative value of oil, obtained from seed grown in the country, and of the imported article, the results of which, have established the perfect similarity of the two products, there are however several precautions to be observed, in the preparation of this oil, the neglect of which has caused the country article to be less esteemed. The oil must be obtained perfectly pure, and unadulterated by the admixture of any greasy oil, which would of course destroy its drying qualities and render it useless for paint, it should not therefore be prepared in a press which has been used for other oils, unless it has been first thoroughly cleansed, a matter of some difficulty with the ordinary native press. To render the oil *drying*, the process although very simple, is one which requires some practice to succeed fully. It is generally effected by boiling 100lbs. of Linseed oil with 1lb. litharge, and maintaining the mixture for an hour at a temperature of 100. Cent. Indian oil thus prepared, is perfectly equal to that obtained from England for paints and varnishes. The imports of Linseed oil, and the exports of seed for the last six years, have been as follows.

OIL IMPORTED.

In 1849-50	Gallons.	1,311	value Rs.	2,623	from England
1850-51	,,	2,832		6,358	do.
1851-52	,,	2,823		5,978	do.
1852-53	,,	4,552		8,763	do.
1853-54	,,	6,505		13,060	do.
		237		474	from Indian ports.
1854-55	,,	2,879		5,270	from England.
		668		1,883	from Indian ports.

SEED EXPORTED.

1849-50	Cwt.	401	value Rs.	1,539
1850-51	,,	801		2,271
1851-52	,,	1,067		2,927
1852-53	,,	1,106		3,275
1853-54	,,	2,898		9,588
1854-55	Quarters	293		5,914

The imports of Linseed oil into England in 1851, amounted to Quarters 608,986.

As a great variety of pigments and of resins for varnishes are procurable in India, the present large item of imports under the head of "paints and colors" might be materially diminished.

The wood oils of India are in themselves natural varnishes, being composed of a mixture of a resin and a volatile oil, they are not however so durable as the Linseed oil varnish, being more brittle and liable to scale off, though they answer well for in-door work; the addition of a due proportion of any good drying oil, would perhaps render them more durable.

Oil,—as used in the manufacture of Candles and Soaps. We now proceed to consider oils in a higher state of manufacture, or when converted into candles and soap.

As regards the former article, it is doubtful whether candles can be manufactured in India at a sufficiently remunerating price to enable a local company successfully to compete with the imported article. This question indeed is one for the practical manufacturer to determine. Candles might be made with ease, but to make them cheaply would involve a large outlay for machinery, &c. The imports of wax and candles (almost entirely the latter,) and the exports of bees' wax are as follows.

IMPORTS.

1849-50	lbs.62.720	Rs. 45,953	from England.
1850-51	lbs. ——	Rs. 4,778	from England.
	lbs. ——	Rs. 2,549	from Bengal and Bombay.
1851-52	lbs.52,478	Rs. 28,720	from England.
	lbs. 6,272	Rs. 4,178	from Bengal and Bombay.
1853-52	lbs.35,366	Rs. 18,213	from England.
	lbs. 2,977	Rs. 1,808	from Indian ports.
1853-54	lbs.41,914	Rs. 21,690	from England.
	lbs. 4,255	Rs. 2,369	from Indian ports.
1854-55	lbs.61,386	Rs. 31,523	from England.
	lbs.10,194	Rs. 3,739	from Indian ports.

EXPORTS.

1849-50		lbs. 2,64,096	Rs. 1,12,270		
1850-51		lbs. 3,13,697	Rs. 86,614		
1851-52		lbs. 2,36,378	Rs. 95,286	to England.	
		lbs. 1,07,260	Rs. 44,726	to Bengal and Bombay.	
1852-53		lbs. 2,32,000	Rs. 99,713	to England.	
		lbs. 65,609	Rs. 27,083	to Bengal and Bombay.	
1853-54	Wax.	lbs. 43,000	Rs. 15,434	to England.	
		lbs. 10,602	Rs. 3,760	to Indian ports.	
	Candles.	lbs. 1,89,886	Rs. 76,834	to England.	
		lbs. 19,776	Rs. 16,377	to Indian ports.	
1854-55	Wax....	lbs. 85,615	Rs. 31,054	to England.	
		lbs. 87,010	Rs. 35,646	to Indian ports.	

IMPORTS RE-EXPORTED.

1849-50	lbs.	10,976	Rs.	4,048	
1850-51	,,	2,412	,,	1,327	
1851-52	,,	4,482	,,	3,266	
1852-53	,,	6,660	,,	2,623	the larger proportion went to Pegu.

Soap.—The ingredients for making soap are ever at hand, and available to the most humble workman. Although the quantity of this substance used by the native population is, it is to be feared, very small, yet the trade would afford ample employment, to a large establishment. A large quantity of the common chunam or country soap, is imported from Bombay, and sold at 1 anna per lb., and upwards. The amount of hard soap annually manufactured in England is stated to be 53,400 tons, of which about 17,800 tons, are made from palm oil, which is imported for this and other purposes to the extent of 50,000 tons per annum.

We are not, however entirely without soap manufactories in South India; Messrs. Kohlhoff, and Prudhomme at Tanjore; Dr. Flynn, and C. Bauloo Moodelly, at Madras, make soap to a greater or less extent. Mr. Kohlhoff of Tanjore, who manufactures soap on a large scale, (chiefly from Illoopoo oil,) for exportation to the Mauritius, as well as for local sale, at 80 Rs. per candy, of 500 lbs., has kindly placed the following remarks on the relative value of soaps, made of various Indian oils at my disposal. I can also add my testimony, to the superiority of the soap made from Illoopoo oil,

according to his method over all other soaps; for a quantity of this soap, exhibited by Mr. Kohlhoff at the Madras Exhibition of 1855, was purchased and kept in an open place exposed to all weathers till the present time, (June 1857.) It does not appear to have sensibly diminished in weight, or to have been affected by heat or damp, but remains perfectly firm and good, whilst English bar soap, under the same circumstances has shrivelled up to two-thirds of its original size. I prefer it therefore to ordinary English bar soap, which does not stand the test of extremes of temperature, nearly so well.

Mr Kohlhoff observes—" *Cocoanut oil soap* is of inferior quality, if exposed to damp it will melt away, and if allowed to dry it will shrink, wherefore it is the object of the manufacturer to prevent loss by making only such a quantity at a time, as he is likely to sell immediately. *Castor oil soap* is too clammy, and from its offensive smell, is unfit for use. *Gingeley and ground nut oil soap*, are like each other, they are certainly better than the Cocoanut oil soap, but not so good as that made from *Illoopoo oil*, which is decidedly superior to all. *Pinnay oil* soap, may be considered as good as that manufactured from Gingeley and Ground nut oils for washing linen, &c. but it has a dirty brown color which is unfavorable to the seller. *Margosa oil soap* is on a par with the above in utility, but may be classed with the Gingeley and Ground nut soaps in point of color, which will be a pale yellow, but the smell of the Margosa soap is unpleasant."

The process of manufacturing the above mentioned soaps, is as follows: " Two cisterns being built one above another, two-thirds of chunam, mixed with one third of Fuller's earth is pressed very tightly into the upper cistern. Water being poured thereon, the lye will slowly filter through, and be received into the lower reservoir.

About two-thirds or three-quarters of this lye (according to the nature of the oil, employed,) is mixed with the oil, and allowed to remain three days with occasional stirring. The whole is then boiled in a copper cauldron, until the soap separates from the lye water. A small quantity of pure cold water, is then poured in and stirred up to clarify. The soap is then poured into moulds, and cut into bars, when cold. When sufficiently dry, it is smoothened and ready for sale."

APPENDIX A.

Abstract Statement of Exports of Oils and Oil seeds from Madras and the subordinate Ports, from 1850-51, to 1854-55.

DESCRIPTION.	1850-51.		1851 52.		1852-53.		1853-54.		1854-55.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Gallons.	Rupees.	Gallons.	Rupees.	Gallons.	Rupees.	Gallons.	Rupees.	Gallons.	Rupees.
Oil Cocoanut	6,56,118	1,44,952	9,56,937	2,11,669	14,57,741	3,18,655	17,97,450	3,89,722	21,41,572	5,08,530
,, Gingeley	77,262	48,605	46,196	26,722	72,607	43,608	1,19,180	73,635	17,139	12,720
,, Lamp	26,093	13,386	24,475	11,979	51,048	20,927	50,770	25,014	45,555	27,069
,, Castor	15,971	25,132	12,600	15,694	8,059	7,818	7,818	8,580	48	144
,, Ground nut	1,10,566	52,840	31,027	14,760	57,207	23,603	82,886	51,760	45,361	31,487
,, Margosa	0	0	1,917	1,048	3,111	1,701	0	0	0	0
,, Pinnacottay	0	0	0	0	0	0	0	2,287	0	1,290
,, Fish	39,489	12,717	77,240	22,157	2,57,217	71,769	7,21,095	2,06,863	2,67,161	77,217
,, Cassia	1,000	3,053	473	1,572	430	1,701	0	0	0	0
,, Other sorts	0	0	0	3,766	0	3,867	0	2,080	0	2,101
Total..	9,26,499	3,00,685	11,50,865	3,09,367	19,07,456	4,93,649	27,79,199	7,59 ,941	25,16,836	6,60,558
Seeds Gingeley	2,27,779	4,37,185	1,09,414	3,02,559	2,51,613	5,31,664	11,98,079	6,93,760	1,67,324	4,31,726
,, Lamp	6,011	12,347	6,125	9,993	73,215	54,228	7,076	17,652	7,044	19,150
,, Castor	14,617	24,096	0	0	2,764	4,247	15,475	24,379	0	0
,, Ground nut	795	1,728	0	0	0	0	0	0	357	1,107
,, Linseed	801	2,271	1,067	2,927	1,106	3,257	2.898	9,588	1,308	5,914
,, Mustard	9,908	22,097	3,636	9,319	16,057	34,048	18,028	39,359	3,098	10,654
,, Pinnacottay	0	0	0	0	360	1,167	0	0	0	0
,, Croton	0	0	0	0	0	0	0	0	143	1,453
,, Other sorts	0	10,648	0	8,874	0	9,300	0	13,543	....	11,055
Total..	2,60,625	510,372	121,511	3,33,072	3,46,584	6,37,929	12,42,930	798,281	1,80,394	4,81,059
Total value of oil and seed	..	811,057	..	6,42,439	..	11,31,578	..	15,58,222	..	16,41,617

APPENDIX B.

Statement showing the total value of Oil and Oil Seeds, exported for the last 5 years, ending 30th June, 1855.

	1850-51.			1851-52.			1852-53.		
	Value of oil.	Value of oil seeds.	Total.	Value of oil.	Value of oil seeds.	Total.	Value of oil.	Value of oil seeds.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Ganjam......	2,530	65,167	67,697	7	108,917	108,924	594	276,682	277,276
Vizagapatam.	9,520	133,465	142,985	3,769	95,074	98,843	4,791	171,987	176,778
Rajhmundry.	10,125	133,182	143,307	11,547	120,894	132,441	25,054	225,536	250,590
Masulipatam*									
Guntoor....	316	14,733	15,049	520	29,069	29,589	490	28,678	29,168
Nellore......	5,138	234,728	239,866	9,972	251,744	261,716	12,498	188,503	201,001
South Arcot..	55,144	109	55,253	11,904	108	12,012	29,178	827	30,005
Tanjore.....	13,528	944	14,472	15,981	1,077	17,058	19,338	2,081	21,419
Madura......	438	20	458	199	0	199	435	1	436
Tinnevelly...	120	3	123	175	0	175	532	38	570
Canara........	43,467	6,692	50,159	40,070	7,669	47,739	64,178	4,948	69,126
Malabar......	167,256	790,779	958,035	255,274	1,003,868	1,259,142	420,157	1,042,871	463,028
Total..	307,582	13,79,822	16,87,404	349,418	16,18,420	19,67,838	577,245	19,42,152	2,519,397

	1853-54.			1854-55.		
	Value of oil.	Value of oil seeds.	Total.	Value of oil.	Value of oil seeds.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Ganjam......	489	186,721	189,210	1,018	167,874	168,892
Vizagapatam.	2,610	207,122	209,732	363	101,615	101,978
Rajhmundry.	21,534	343,986	365,520	17,022	222,879	239,901
Masulipatam*						
Guntoor....	314	42,099	42,413	270	29,342	29,612
Nellore......	7,844	98,447	106,201	5,757	9,042	14,799
South Arcot..	41,977	1,465	43,442	21,229	429	21,658
Tanjore.....	28,107	21,256	49,363	39,837	239	40,076
Madura......	873	83	956	172	2	174
Tinnevelly...	1,238	751	1,989	634	1,916	2,550
Canara........	128,870	6,239	135,109	98,494	16,364	114,858
Malabar......	654,146	849,262	1,503,408	643,119	759,366	1,402,485
Total..	888,002	17,57,431	26,45,433	827,915	13,09,068	21,36,983

	TOTAL.			AVERAGE.		
	Value of oil.	Value of oil seeds.	Total.	Value of oil.	Value of oil seeds.	Total.
	Rs.	Rs	Rs	Rs.	Rs.	Rs.
Ganjam......	4,638	805,361	809,999	927	161,072	161,999
Vizagapatam.	21,053	709,263	730,316	4,211	141,852	146,063
Rajhmundry.	85,282	1,046,477	1,131,759	17,056	209,295	226,351
Masulipatam*						
Guntoor....	1,910	143,921	145,831	382	28,784	29,166
Nellore......	41,209	782,464	823,673	8,242	156,492	164,734
South Arcot..	159,432	2,938	162,370	31,886	588	32,474
Tanjore.....	116,791	25,597	142,388	23,350	5,119	28,477
Madura......	2,117	106	2,223	423	21	444 }†
Tinnevelly...	2,699	2,708	5,407	540	541	1,081 }†
Canara........	375.079	41,912	416,991	75,016	8,382	83,398 }†
Malabar......	2,139,952	4,446,146	6,586,098	427,990	889,229	1,317,219 }†
Total..	29,50,162	80,06,893	109,57,055	590,031	1,601,375	2,191,406

REVENUE BOARD OFFICE,
FORT ST. GEORGE,
9th February, 1857.

(Signed.) G. S. FORBES,
Acting Secretary.

* The quantity only is given, but no value.

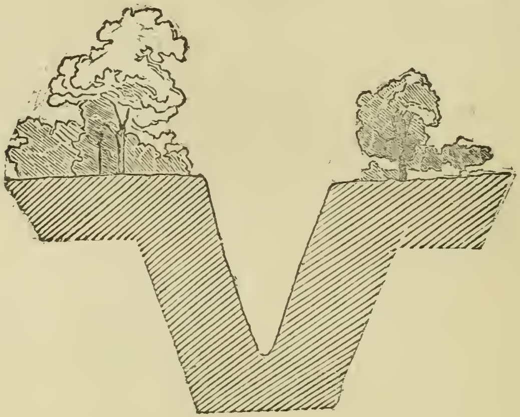
† Land frontier is not included in this.

II. *Description of the method adopted in the Coimbatore District for catching wild Elephants. By* CAPTAIN D. HAMILTON, *Assistant Conservator of Forests.*

I beg to enclose some rough sketches (Plates I, II, III and IV.) referring to the late Elephant Hunt, which, with a brief description, may be of some interest, showing the method adopted in the Coimbatore District for capturing wild Elephants.

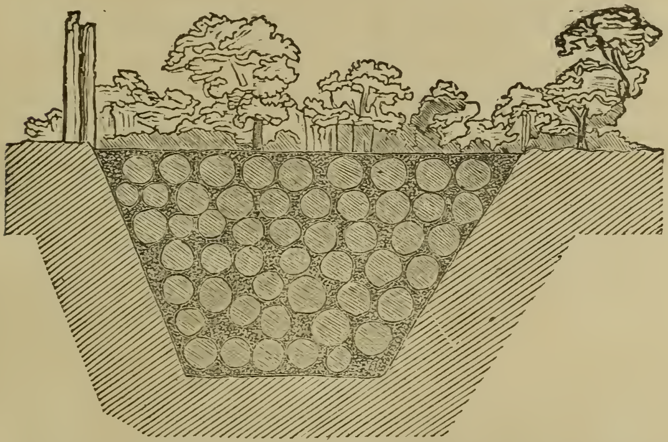
The spot selected for the hunt on this occasion, was at the entrance of a valley (vide Plate I) at the foot of the Neilgherries near Seermoogay, where are the remains of an old Coopum or Kraal. The situation was an excellent one, for the river on one side, and steep hills on the other, left only a narrow gorge at the entrance of the valley; so that once having got the Elephants into the valley, it appeared easy enough to drive them into the Coopum.

The Coopum consisted of a circular trench 280 feet in diameter,



(vide Plate III) the breadth of the ditch being 13 feet, narrowing at the bottom to a few inches; the depth 10 feet. The causeway at the entrance 17 feet broad was composed of blocks of light wood, and earth. The object of using wood was to enable the causeway to

be quickly demolished on the Elephants entering the enclosure. From the entrance strong palisadings were erected (vide Plate IV.) diverging in one direction towards the river, and in the other to the foot of the nearest hill, the length of the right palisading (looking from the Coopum) was 600 feet, that on the left 800 feet consisting of stems of trees firmly fixed in the ground and strongly bound together. 2,800 of these stems were used in forming the palisadings, beyond them strong abattis were laid down, extending on the right side 2,900 feet and on the left 3,200. For 400 feet on each side behind the palisading, a ditch 5 feet 7 Inches broad and 3 feet 6 inches deep was dug; beyond this, a ditch 4 feet by 4 feet was continued, but on the *inner side* of the palisading and abattis, on the right side to the distance of 310 feet and on the left 180 feet.



This completed all the preparations with the exception that on the day of the drive, the whole of the palisadings were covered with green branches, to conceal them from the Elephants. All trees and bushes were left standing, and the causeway was made to look as like the natural jungle as possible, the ditch at the sides being carefully concealed by bushes.

It took several days to bring the Elephants into the valley, (vide Plate II) above the Coopum, as they have to be moved in the direction required, without alarming them. Parties had to be stationed, day and night watching certain passes, to stop the herd from

proceeding in any direction but towards the valley; at nights a line of fires are lighted for this purpose. On the day of the drive people are stationed at intervals outside the palisadings and abattis, to drive back the Elephants if they attempt to break through. Two small bon-fires are made on each side of the entrance, within the Coopum concealed by bushes, and the moment the Elephants enter two men are ready to rush in and light them ; faggots which have been previously collected and piled near the entrance, are quickly thrown on and soon two immense fires are formed which effectually prevent the Elephants attemping to recross the causeway, while a number of coolies detailed for the purpose are demolishing it.

Muskets, rockets, crackers, tom-toms and horns are used in the drive, which combined with the shouting of several hundred men is enough to intimidate the boldest Elephant from charging back, but it is difficult to get Natives to believe this. Every thing depends on their having good leaders.

Besides those employed in guarding the enclosures, and driving a number of men are placed on the flanks beyond the arms or enclosures of the Coopum, as soon as the drive commences they light small fires, the Elephants have such a dread of fire, that if well-driven, on seeing the fires on each side of them, they are sure to make straight for the enclosure.

III. *Notice of the occurrence of Crystalline Limestone in the District of Coimbatore. By* H. F. BLANFORD, ESQ. *of the Geological Survey of India.*

During the progress of the Geological Survey of the Neilgherry Hills in the months of June to November of the current year, my attention was called to some specimens of Crystalline Limestone collected by Dr. Cleghorn and Capt. Francis, Engineers. This discovery of limestone, which is of the greatest interest both in an economical and scientic point of view, induced me to avail myself of an early opportunity to visit the locality in question, in order to ascertain the nature and extent of the mass of limestone, from which the

specimens were obtained. The chief results of the examination are embodied in the following notice.

The whole surface of the district of Coimbatore as well as the Mysore table land, and indeed the greater part of S. Western India is composed of a vast spread of Schistose or foliated rocks, such as Gneiss, Hornblende Schist, Mica Schist, &c., a class of rocks termed Metamorphic by Sir Chas. Lyell, (although such a term must be regarded as premature until their really metamorphic nature *in all cases* be firmly established.) The mineral characters of these rocks are extremely varied, but they consist for the most part of Quartz, Feldspar, Hornblende and Garnet, intermixed in various proportions, one or more of these minerals being occasionally entirely absent. Mica which is one of the constituents of true Gneiss is only of exceptional occurrence in the district in question. The foliation (or system of laminæ) in which the constituent minerals of schistose rocks are arranged, is well marked over the greater portion of the Coimbatore district, but is far less distinct on the elevated plateau of the Neilgherry Hills, and occasionally disappears altogether, so that were it not that such non-foliated rocks pass invariably by insensible degrees into others in which a foliated character is distinctly discernible, they might be easily mistaken for Syenite, Greenstone or some other kind of Plutonic rock, an error into which previous observers have generally fallen. The foliation wherever apparent conforms to a general strike in the direction E. N. E., W. S. W. on the plateau of the Neilgherry Hills, and such is also its direction in the vicinity of Coimbatore. In other portions of the district it varies considerably and towards Bhovani it has a North Western strike. Granite veins of small size, are occasionally seen cutting through the foliated rocks, which form the surface of the low country, but on the hills generally no trace of Granite or any of the allied Plutonic rocks has been detected. A few small dykes of Basalt being the only intruded rocks of the elevated country.

About 5 miles to the south of the Civil station of Coimbatore, a low broken ridge of hills characterised by a peculiarly jagged outline occurs crossing the road to Palghat and running in an E.

N. E. direction. These hills consist of thin alternating bands of crystalline, limestone and gneiss, the banded structure of which is absolutely coincident with the foliation. Here and there small contortions occur in the rock, which are rendered very strikingly visible by the erosion of the intercalated band of the limestone from atmospheric causes, and it is this unequal erosion which has given to the hills themselves the jagged appearance already alluded to.

The range of hills ceases suddenly about half a mile to the east of the road where the rock becomes much contorted, and an exposed surface of pure crystalline limestone, unmixed with Gneiss extends for the space of about 200 yards, between the hills and the cultivated land beyond. The limestone is largely crystalline, being composed of an agglomeration of small rhombohedrons of Carbonate of Lime, the characteristic cleavage of which is frequently very distinct. In color, it is usually of a pale mottled grey, frequently passing into pink, and occasionally becoming nearly white. It is intersected by a few minute veins of Granite, which have apparently been intruded while the limestone was in a molten condition, so that by slight movements in the fluid mass, they have been drawn out and twisted into peculiar thread like forms, resembling those frequently seen in the intermixture of two colors on the marbling trough of a bookbinder. In general, the rock is very compact and blocks or slabs, of almost any required size, might be quarried without much difficulty.

From this spot, which is the most easterly point at which the limestone is at present known to occur, it passes westwards forming a band of 30 or 40 yards in width in the substance of the schists, into which it graduates along its northern edge, forming the banded rock already described, while its vertical extent is probably very great. It has been traced for a distance of about 7 miles along the foot of the range of hills already mentioned, which to the West of the Palghat road, become very elevated and form a ridge of about 2,000 feet in height above the general surface of the surrounding country. At a point about 2 miles west of the village of Ittrumudday, the line of Railway from Madras to Beypoor, cuts

the band of limestone and passes to the westward along its outcrop, and in some of the small cuttings, good faces of the rock are exposed. The blocks obtained from the cuttings, are used for rubble work in the construction of the bridges, &c., on the line. Further to the west the limestone band penetrates the Walliar jungles, beyond which point it has not been traced, but it is not improbable, that it extends much further in the same direction.

It is unnecessary here to enter upon any theoretical considerations with respect to the limestone, as these will be treated of at length, in connection with the Geology of the surrounding country, in the Report now preparing for publication, in the "Memoirs of the Geological Survey of India," but a few words on the economic importance of the discovery may be here fitly added.

As a building material, limestone such as that now described is capable of a two-fold application. It may either be used in the form of rough or worked stone, or may be burnt in some form of kiln for the manufacture of lime and cement. As a building stone, the Coimbatore limestone would be perhaps one of the cheapest and most durable materials, that could be used. Being extremely soft and very massive, large blocks could be quarried and dressed with great ease, and as from the purity of the stone, it is but little liable to weather or decompose, as is seen on the mere inspection of the stone in situ, dwelling houses or public buildings constructed with it would require no stucco, and would thus present a more sightly and imposing exterior than an ordinary pucka building, and at the same time, a considerable saving in the expenditure for repairs would be effected. This saving alone would in a few years more than cover the original difference of cost. For internal decorations of a simple character, the limestone is well adapted, as it is susceptible of a high polish, and by employing slabs of various colors, very beautiful walls, pavements, &c., might be constructed. It would not be applicable for highly decorative work, such as small mouldings or carved ornaments, since owing to its largely crystalline structure, it would be liable to chip, but this very character imparts to it a transparency which would much enhance the sbeauty of a polished slab. It is, however, possible that extended

research might discover limestone, of a finer grain in some portion of the band.

For the manufacture of lime, the limestone is well adapted. The lime obtained from it would be very pure, and of the class termed rich limes which require the admixture of a certain amount of clay to make them set rapidly. Hitherto, kunkur only has been used for the manufacture of lime, in the Coimbatore district, and for local purposes this undoubtedly answers extremely well, but as it no where occurs in any great thickness, and is distributed in irregular patches over the surface of the country, the supply of lime obtainable from this source is limited. It is probable also that in the event of the limestone being quarried for building purposes on a large scale, the small fragments and chippings burnt on the spot and packed in casks or air-tight boxes, would be cheaper material for conveyance to a distance, than the kunkur which is not only a very bulky material, but in this district generally occurs on dry arid ground where but little fuel is available.

For the production of iron, the ores of which are abundantly distributed over some parts of the Coimbatore district, the limestone is eminently fitted, and the neighbouring jungles of Walliar and the Malabar Coast yield a plentiful supply of fuel.

Finally, the limestone is admirably situated as regards facility of transport to distant localities. The Railway from Madras and Salem to Beypoor, passes as above-mentioned for some distance along the band of limestone, so that the cuttings of the Railway are in the stone itself. Were quarries opened along the side of the line, the blocks of dressed stone might be placed on trucks in the quarry and transported without expense of reloading to any point on the line, while by transporting to the Cauvery and transferring to boats, the stone might be easily conveyed to Trichinopoly and other places in that district.

IV. *Description of a Cyclone at Nellore, on 2nd November* 1857. *By* LIEUT. JOHN MULLINS, *Madras Engineers.*

Nellore was visited yesterday (Nov. 2nd) by a hurricane of unusual violence, which has devastated the station, and the surrounding neighbourhood, and done an enormous amount of damage to property of every description, both public and private.

The sky on Friday and Saturday, the 30th and 31st ultimo, had a leaden appearance, which made the Natives think that there would be a high wind. On Saturday night and Sunday morning, (1st Nov.), there were moderate showers with a strong wind from the west, and towards evening the wind had increased to half a gale. The aneroid and mercurial barometers were both falling, and at $\frac{1}{2}$ past 9 P. M., the former showed a fall of $\frac{1}{10}$ths of an inch and the weather was what is generally called by seamen "very dirty." From this time to 0·45 A. M., the wind continued to increase, and was then blowing a heavy gale, with a good deal of rain. The aneroid barometer had fallen very nearly $\frac{3}{10}$ths since $\frac{1}{2}$ past 9 or $\frac{4}{10}$ths altogether; a little before 4 the gale had increased to a hurricane, trees on all sides were being torn up or broken off, and it was only with great difficulty that doors and windows could be kept shut. The hurricane continued to increase until $\frac{1}{4}$ to 5, when the gusts were terrific, the aneroid had fallen $\frac{7}{10}$ths of an inch in 4 hours, and was still going down rapidly. Shortly after $\frac{1}{2}$ past 5 I fell asleep, and on awaking at $\frac{1}{2}$ past 6, I found to my surprise that there was a perfect calm, but on examining the aneroid, I found that a further fall of nearly $\frac{3}{10}$ths had occurred during the preceding hour, and in 10 minutes more a further fall of $\frac{1}{10}$ths took place. I then knew that we were in the centre of a cyclone, and that before long the wind would recommence with probably equal fury. All this time the direction of the wind was from west and northwest, and ultimately about north north west, as nearly as

could be judged by the result of its operations on the houses and trees. The scene out of doors was, at this time, one of utter desolation ; out of many hundreds of trees which the night before had stood covered with the rich foliage of this period of the year, three-fourths were blown down, and nearly all the rest stripped of branches and leaves. Tiled houses were more or less unroofed, walls had fallen and were crumbling, balustrades of terraced houses were in a ruinous state, and the low country was flooded.

I started off to look at the Tank, which I was afraid must have sustained serious injury, and I hoped to be able to get back before the gale became again serious. On the bund I found Captain Ritherdon and the Tahsildar, together with several peons and some of the Ryots. The Tank was but little injured, but there was a heavy swell running against the revetment, and the waves were breaking high over the Calingala. I had barely reached the bund when the gale came on again with great violence, and in 2 or 3 minutes a hurricane set in which exceeded greatly in its violence what we had felt early in the morning, the wind being from south east. The massive stone gate way of a small Hindoo temple, situated on the bund, afforded some shelter, and here we were forced to remain as no man or animal could for a moment have withstood the wind, as it was then blowing, and the sheets of water that were driven over the bund, were enough of themselves to prevent any hope of forcing our way to the nearest house, which was not more than about 300 yards distant. The Pagoda was built many years ago, when the bund of the Tank was much lower, and as this latter has been raised, a thin bund strongly rivetted on both sides with stone has been built up between the Pagoda compound and the Tank. On this wall, the waves which by this time were something terrible, soon began to tell, and in 20 minutes the wall was breached in several places and the court of the temple was deluged with waves and spray. The spot at which Captain Ritherdon and myself stood was within 4 or 5 yards of the edge of the bund, the state of which and the effect of the waves upon it were anxiously watched, but so thickly was the water blown over the bund, that frequently many minutes elapsed ere the front of the bund could be distinguished, and as it from time to time ap-

peared, it became evident that the rivetment was fast falling, and the earth work in rear washed away. This state of affairs continued for about one hour, during the whole of which time no object 20 yards distant had been visible, and the trees immediately in front of the temple, which were too deeply embedded in the earth to be uprooted, had been reduced to mere shapeless stumps. About this time ($\frac{1}{4}$ to 9) the wind began to shift a little to the eastward, and we then knew that, if the bund could hold out a little longer, no further serious damage would occur to the part on which we were standing. The change in the direction of the wind rendered however our position, on the outer pial of the doorway, no longer tenable, and we sought refuge in the middle recess, with the Tahsildar and the other natives. The wind continued to shift still more to the eastward, and the houses abovementioned in a few minutes again became visible. The moment the spray and wind had sufficiently subsided, we quitted the Pagoda which by this time was by no means a safe place, though probably deemed by us more insecure than it really was, and made the best of our way against the gale, until the shelter of some walls enabled us to get on a little faster, and thankful were we when we again stood on the main land, after crossing, with considerable difficulty, the piece of ground and bridge over the surplus channel, which before had intervened.

When I reached home, at $\frac{1}{2}$ past 9 o'clock, I found the barometer had risen $\frac{4\frac{1}{2}}{10}$ths, and by 10 o'clock, $\frac{3}{10}$ths more towards fair weather had been attained. The hurricane rapidly subsided into a strong gale, and from that to a moderate one, and by $\frac{1}{2}$ past 11 or 12 a fresh breeze only remained, blowing from the east by south and south east, and from that point it has continued to blow ever since.

I cannot say exactly what the barometer stood at for the 48 hours preceding the setting in of this terrible hurricane, but I subjoin the readings taken by me during the night of the first, and morning of the second November; they will give a fair idea of the extent and character of the barometric fluctuations, and I subjoin the reading at 12 noon this day, which will show the usual state of this particular barometer in fine weather.

Aneroid Barometer.

1st	9 30 P. M.	28·25	
2nd	0 45 A. M.	28· 6	wind from N W. with a good deal of rain.
,,	3 0 ,,	27·80	
,,	3 30 ,,	27·74	
,,	3 45 ,,	27·70	
,,	4 30 ,,	27·62	
,,	4 45 ,,	27·55	hurricane at its height.
,,	5 30 ,,	27·37	
,,	6 30 ,,	27·16	a lull from 6 o'clock to ½ past 7.
,,	6 40 A. M.	27·08	
,,	7 50 ,,	27·25	blowing hard from south and south east.
,,	9 30 ,,	27·70	a terrific hurricane from 8 to 9 A. M.
,,	10 0 ,,	28·00	strong gale but breaking fast.
,,	10 45 ,,	28·10	
3rd	12 0 noon	28·50	

The above observations show that between 9·30 P. M. of the 1st and 6·40 A. M. of the second, the barometer fell 1 inch, and 11 hundredths, and that the total fall from the fair weather average was 1 inch and $\frac{4}{10}$ths, a fluctuation which is I believe enormous, and far exceeding that of the gale of last year, which amounted to $\frac{2\frac{1}{2}}{10}$ ths of an inch only.

In the afternoon I visited most parts of the residents' lines, a portion of the town, and the tank, and on every side there was nothing but desolation; many of the roads were entirely blocked up with trees, every tiled house was more or less damaged, in some cases hardly a tile being left on the exposed side; sheds built on substantial laterite pillars were levelled with the ground; the interior of the Church presented a sad spectacle, the doors and windows had blown open, and the benches had been thrown about by the wind like feathers, the books were lying in the water in pieces, the register which had been in the vestry was lying torn and spoilt under the communion table, the harmonium was blown from near the main entrance to the other end of the Church, where it remained among the ruins of benches and tables, the roof of the Church was laid bare of tiles for about $\frac{1}{8}$ of its area, and to crown the des-

truction, the N. W. pinnacle (15 feet high) of the tower fell from a height of 60 feet through the roof of the west aisle, (the Church is built north and south), even the boards supporting the pulpit cushions and the brackets of the wall-shades were broken by the benches, which appear from the marks on the walls and pillars to have flown about in all directions. The Court house, place of arms, Public Bungalow, Jail, the new Engineer's Office, and the work shops, in fact every tiled building suffered damage, and even the best houses in the place were barely habitable, owing to the wind having, in some cases, blown in the doors and windows, and in others blown out the glass or forced the rain through the venetians. The pillars on the Annicut, recently built to carry the Telegraph wire, which were 18 feet high and which were elliptical in plan, the diameters at base being $4\frac{1}{2}$ feet and 2′, and at top $2\frac{1}{4}'$ and 1′, were blown away; one being broken off at the base, another at 7′, and the third at 10 feet from the base, and the lower portions of the latter two were so much injured, that they were carried off by the river, when it had risen to about 5 feet above the crown of the Annicut. At Nellore, very little loss of life appears to have occurred, which is the more wonderful as many houses were blown down, and some were crushed by falling of trees. Reports have not yet been received from the neighbouring country, but the dead cattle of all descriptions, both in the tank and in the river, show that the destruction of animals has been very great.

When I visited the Annicut this morning, I found $10\frac{1}{4}$ feet of water going over its crown, and the marks on the guage showed that more than 11 feet had been reached. The superintendent informed me that, up to $\frac{1}{2}$ past 11 A. M. yesterday, the water was below the crown, but that it then commenced rising and in a couple of hours had risen to 7 feet above the crown, and about 12 midnight it reached its highest level. The Head sluice recently erected has enabled us to control the water in the Jaffersaib Channel, but the Head of the Survapully Channel being open, owing to the non-sanction of the estimate submitted last year for bringing it under the Annicut main Channel, and closing the old head, the flood has found its way in at this point, and inundated the country to the east and south-east of Nellore, thereby doing much injury

to the tanks as also to the fields and young crops. This flood is almost entirely due to the bursting of tanks to the westward of Nellore.

The Nellore tank is breached in two places, but only at the shallower portion, and there will be no difficulty in retaining a full supply. The rivetment is very much injured, however, and in many places for 4 or 500 yards, at a length, will have to be entirely rebuilt. Breaches were in many places imminent, but altogether the bund has withstood the severe trial very well, as in addition to the force of the wind, it received during yesterday, the drainage of a large tract of country and the whole of the water of Mooloomoody, Condlapoody and Ambapoor tanks, which breached during the storm.

V. *Notice of the same Cyclone at Cuddapah, on 2nd November* 1857. *By* LIEUT. E. HEMERY, *Madras Engineers.*

The following account of a storm which visited the town and neighbourhood of Cuddapah, on the 2nd instant, may not be uninteresting.

Sunday the 1st was calm with light clouds from the north east; at sunset, the sky became completely overcast, and towards morning of the 2nd, the wind shifted to the north-west from which quarter it was blowing furiously at 6 A. M. accompanied by very heavy rain.

The storm increased in violence up to noon, and from that time until 4 P. M. it blew a perfect gale, the rain continuing to fall without the slightest intermission.

Towards evening the wind went round to the south-west and south, it then gradually fell, the rain ceased and by midnight it was quite calm.

I am happy to be able to report that the tanks, bridges and other public works in the immediate vicinity of Cuddapah, have

sustained little or no injury, the native houses however in the town have been greatly damaged, and many of the roads were impassable this morning owing to the number of uprooted trees lying across them.

The following observations of the Aneroid Barometer were made during the day.

November 2nd,	6 A. M.	29·425
	9 A. M.	29·35
	Noon.	29·27
	1 P. M.	29·2
	4 P. M.	29·18
	8 P. M.	29·185
November 3rd,	8 A. M.	29·45

4·58 inches of rain were registered during the day at the Civil Hospital.

VI. *On the line selected for the Madras Railway. By* Colonel T. T. Pears, *Consulting Engineer.*

(The Editors having learned that the article by Colonel A. Cotton in the 3d No. New Series, of this Journal, had elicited certain observations addressed to the Government, by the Consulting Engineer for Railways, on those portions which had reference to the Madras Line, applied to the Author for permission to insert them, on a question affecting so much the progress of this Presidency. The Paper not having been prepared in the 1st instance for publication, Col. Pears expressed some hesitation in complying with their request, but at last consented, disclaiming any wish to enter into controversy—Ed. M. J.)

My attention has been drawn to a report, printed in the Madras Journal of Literature and Science, No. 42, April to June 1857, by Colonel Arthur Cotton of the Engineers upon the subject of the proposed pier ; but discussing mainly the subject of a break-

water, and alluding, incidentally, to the Madras Railway in the following terms.

"Without a harbour at either end and merely as a line connect- "ing the East and West Coast of the Peninsula, I look upon this "work as one of the least important lines on which 3 millions "could have been spent, assuredly nothing of any consequence "either in goods or passengers will ever be conveyed by it from "one Coast to the other, and at least 200 miles of it are perhaps "about the least productive line of country that a Railway could "be carried through in India. Further, it is proved beyond all "question that the passenger traffic is the main source of profit "on Railways and that the great mass of passengers only travel a "few miles (the average for all England is 13) that is they go to "the next town and back—strange to say this Railway of 450 "miles is not to pass through one of the few towns (only 7 and "all but one very small) which lie near its route so that it looks "as if the ultimate object had been to make a Railway not to "carry the people."

As this expression of opinion, though not given in relation to any question proposed in the Railway Department, has been before Government, I consider it right to offer a few remarks upon it.

The Madras Railway is here spoken of as being without a harbour at either end, and, therefore, one of the least important lines on which 3 millions could have been spent. As there are no harbours on this Coast, and none deserving the name, unless it be Sedashegur on the other, south of Bombay, it would be difficult to say which would be the more important line that Colonel Cotton would have proposed. A natural harbour is doubtless a very good thing ; but that in this part of the world, a considerable trade may be carried on without such, is proved by the large and increasing commerce of Madras. Moreover, the fact that Nature has denied harbours to the Peninsula of India, does not appear a sufficient reason for the Government denying its inhabitants the benefit of Railways to bring their produce to the Coast.

Colonel Cotton then goes on to state, that the Railway "is not to pass through one of the few towns (only seven and all but

one very small) which lie near the route," and observes, that it looks as if the object was to make a Railway not to carry the people. That the towns referred to are all, but one, very small, is a circumstance sufficient in itself, one would suppose, to account for the fact of which he complains, viz., that no great sacrifice has been made with the view of leading the trunk line of rail through them.

I have the highest respect for Colonel Cotton's public character and abilities, and of those who will read these remarks there are few probably who do not entertain the same feelings. It is impossible, that any observations can fall from an Officer of his character and position, without leaving their impression upon the minds of many, especially of those who have not been accustomed to the consideration of such subjects.

In reference to the passenger traffic, and in order to show its nature and importance, Colonel Cotton asserts, that it is proved beyond all question, that the passenger traffic is the main source of profit on Railways, and that the great mass of passengers only travel a few miles.

In the first place, I have never seen the former fact proved, and it is primâ-facie opposed to Colonel Cotton's recorded opinions, upon the extreme cost of speed—the passenger traffic being carried at a much higher rate than the "goods." It is known too, that in England the receipts from goods have been increasing year by year, faster than those from passengers ; and in the Parliamentary reports for 1855, it is stated that whilst in 1849, the proportion of the passenger traffic* to the goods traffic was as 53 to 47, (the passengers in excess), in 1855, the passenger traffic is represented by 44, and the goods traffic by 56. In Scotland the average receipts for goods traffic are very nearly two-thirds of the total traffic, and it is added "the preponderance of the goods traffic over passenger traffic is more marked in the manufacturing and mineral than in the agricultural districts," that is, in those very places where the collection of men in large towns would lead us to expect the contrary.

* i. e. the gross receipts.

Again, Colonel Cotton is, as far as I can learn, in error in naming 13 miles as the average distance travelled by passengers for all England of all classes. In the report for 1855, the average receipt from passengers (exclusive of season tickets) is 19·20 pence, the average fare per mile 1·28 pence. The average distance travelled is $\frac{19 \cdot 20}{1 \cdot 28} = 15$. For the United Kingdom it is 14·9.

But I follow this no farther, because I think it very unsound to build systems and theories for India upon English experience. Take for example the statement regarding the preponderance of passengers and goods traffic. If in one and the same country, as England, there be different lines of Railway, some making their chief profit from passengers, some almost wholly from goods (and one of the latter the Taffvale has been long distinguished as one of the most profitable works in England); if this be the case there, we may well look for a difference in this respect in different countries.

No two countries would be found to offer more different prospects to a Railway than England and India; the one confined within narrow limits with a dense and wealthy population, actively engaged in manufacture and as such collected in large towns, whose existence is secured by permanent and natural causes; the other a country of vast extent, with scanty and scattered population, wholly engaged in agriculture, or in commerce connected therewith—the few large towns scattered widely apart, existing in dependance upon accidental and ephemeral causes.

The difference between the aim and prospects of a Railway, or system of Railways, in a manufacturing and in an agricultural conntry is, as great as this, that in the one case the attention would be immediately directed to the large towns—the seat of mineral and manufacturing wealth—in the other the object would be to drain, as completely and cheaply as possible, a large tract of country of its agricultural produce.

The latter is the case with us here. The line running inland from Madras seeks thus to serve directly the inland districts of North-Arcot, Salem, Coimbatore, and Malabar; while until the

other lines are formed, it indirectly serves those of Mysore, Bellary, and Cuddapah on the one hand ; Trichinopoly and Madura on the other.

The first point to be aimed at, therefore, is to get a good main line through these districts. If considerable towns are found in the way (Colonel Cotton says there is but one), the Railroad should be taken to them if it can be done, without disproportionate sacrifice of expense, either in increasing the length or the difficulties of construction.

What amount of sacrifice should be made with this object will depend upon circumstances now to be noted.

The size of the Town.

The probable duration of its existence.

The probable effect of its distance from the rail on the traffic of the line.

I shall first consider the last point, viz., the probable effect of the distance at which a line passes a town upon the traffic. This depends mainly on the passenger fares. It depends also on the character of the country and condition of the people, by which the average distance travelled by the inhabitants is affected.

Thus, if the fare by rail is $\frac{1}{2}$ the expense of travelling by road, it will cost a man, living three miles from a station the same in going to a point on the line 5 miles off in a direct line, whether he goes by high road or by rail. If the place be more than 5 miles off, it will be cheaper to go by rail if less, dearer.

Now the average distance travelled by rail by passengers in England is shown to be 15 miles. Colonel Cotton has stated it erroneously at 13, and has unreasonably, I think, taken this as a data for Railways generally all over the world, but nothing can be more clear than that in this, as in all other respects, but in this respect, preeminently, the traffic in this country must differ from that in England.

There, we have a large wealthy population dwelling within narrow limits, and a land thickly studded with populous Towns and

villages. On *this* vast expanse of country, large towns are few and far between, and the population scantier and more scattered.

According to our last half-yearly return, the average distance travelled on a line 65 miles in length was 38 miles; what will it be when we have it complete 450 miles? I have no doubt that the average will be above 30, even though the fares should be reduced as I trust they will.

That the line should pass $2\frac{1}{2}$ or 3 miles from Wallajahnuggur and 4 from Vellore does not, in my opinion, affect the traffic coming from those towns in the slightest degree. It may, but it is a question whether it does affect even the traffic between those two particular places. This depends on the fares also. A man can travel, even at the present high rates, cheaper and quicker by rail between those two towns than he can by the high road. All other traffic from them to any point on the line 10 miles and upwards, from each of their respective stations, would take to the rail.

But, is the short and insignificant passenger traffic, between those two towns, sufficient inducement to change the course of the line of Railway, and adopt one less beneficial to the districts at large, a worse and more expensive line, crossing the Palar at a much more inconvenient place, and cutting up a large amount of valuable land on the right bank of that river? I think not.

These towns do not in the least degree resemble the large towns of England. They possess not one element of permanency. These the only two of any considerable size along the line, owe their existence to causes that may cease at a moment, and will cease ere long.

In an agricultural country like this, the large towns are chiefly local market towns, or emporia of agricultural commerce. They are singularly uniform in size and importance; sacred temples, the contiguity of Civil and Military stations, being the circumstances that generally give one such town importance over another.

Take Vellore the largest town on the line of Rail. It owes its present extent wholly to three causes. It is a local agricultural mart, a Military station, and it is a rendezvous for a great portion of the traffic from the inland districts en-route for the coast.

It possesses no manufactures, no mineral deposits, not one element of permanency or stability. Of the three main sources of its present populousness, the Railway is certain to destroy one, to materially curtail another, while a few strokes of the pen, in the shape of an Extract Minutes of Consultation, would at once remove the third.

The effect of the Railway, had it run right through it, would have been precisely the same, as it will be now, entirely to destroy its business and importance as an emporium of trade, with the distant provinces, with Mysore, Bellary, Salem, &c. The same effect has been produced by Railways in England in numberless cases, some of which have fallen under my own immediate observation. The large traffic that now passes into Vellore from Salem, Bangalore, Mysore, and Bellary, will, as the rail advances towards those places, be conveyed at once through it, and the number of people now residing there, connected with this traffic, will disappear.

Had the line run right through these two towns, it would have been the same; nothing would be left them but the importance due to a Railway station, and even this would be a fall from their present condition, considered merely as local agricultural centres, since stations, on each side of them, within 6 or 8 miles, would draw away much of the business that, in the present state of the communications, passes into these towns.

Nothing will remain to give Vellore special importance, but its Fort and its Garrison; and it is not probable that the latter will ever be considerable.

The other towns near which the line passes are Gooriathum, Vaniembady, Tripatoor, Salem, and Coimbatore. To some of these it passes quite close, but the same principles apply. In some cases, as Salem, it appears a positive good that the station should be 2 miles away, on a high and apparently healthy spot, to which many traders will be attracted leaving the present town, which like many others in this country, seems to have been planted on the most unhealthy spot that could have been selected.

I think for the reasons I have now given that the present towns, existing wholly upon temporary and accidental causes, as

the proximity of roads, passes, European stations, &c. are by no means deserving of the same consideration that is due to such towns as Birmingham, Manchester, and Liverpool; to sea ports, or to the abodes of men clustered round, and upon, an inexhaustible supply of Coal and Iron.

These towns of ours have no local products, every article now brought out of them is due, not to the town itself, nor to the people in it, but to a tract of country of which it has hitherto been, but which the Railway station will in future be, the centre.

I would not needlessly compel the few who may remain, when the busy *through* traffic has disappeared and passed by the rail, to shift their dwellings to a station 2 or 3 miles off, but the sacrifice to them is inconsiderable, compared with that to the Company in selecting a worse and more expensive line, merely to accommodate a town and a group of people, destined to melt away under the operations of the Railway itself.

The Railway has to do with a great agricultural District, and whether it lies a few miles this side, or that, the business coming into it will be the same, depending, as the sphere of its operation depends, on its " rates and fares."

It has often occurred to me, as a thing to be borne in mind, that the distribution of the inhabitants of this country has not attained to any thing like a normal state. Had we laid down Railways in England 300 years ago, the lines then laid might have been useful even now, but they would certainly not be of the first importance.

We have seen within short spaces of time, collections of human beings rise and disappear with political changes; and we may be quite sure that whatever particular course they follow, few changes will be more marked than that which must follow the introduction of Railways through these agricultural districts, with stations at every 6 or 8 miles.

The men engaged in trade, however, distributed now, must and will cluster along the line. Such towns as Wallajahnuggur and Vellore, established under, and due to, a totally different order of things, must and will, to a great extent disappear.

Individuals may, and some must, of necessity suffer from such changes as these, but no man can doubt the ultimate benefit to the country; and if the change be necessary there is in this country some satisfaction in the thought, that a new, and, we may hope, a more enlightened and enterprising class will owe their rise to the Railways, while the opportunity will not be lost of introducing into the towns thus springing up a new, more healthy, and more civilized description of dwelling.

VII. *A List of Neilgherry Ferns. By the late* Dr. B. Schmid.

[These Ferns were partly collected by Dr. B. Schmid in the years 1831-35 for Professor Zenker of Jena; partly by Dr. Weigle for Dr. Kurr of Stuttgart, and the Lycopodiaceæ by Mr. Perrottet.

They were described by Professor Kunze, in the Linnæa, Vol. VIII., July 1851. The Professor's last labour before his death; The capital S. indicates that the plant was found by Schmid himself, and W. that it had been collected by Weigle.]

Ophioglosseæ.

1. *Ophioglossum Schmidii*, (Kunze,) Nova species, sent by S.
2. *Botrychium lanuginosum*, (Wallich) sent by S. and W.

Gleicheniaceæ.

3. *Mertensia dichotoma*, (Sw. syn. fil.) sent by S. and W.
   Syn. Gleichenia dichotoma, (Hooker sp. fil. 1, p. 12.)

Osmundaceæ.

4. *Osmunda regalis*, (Linn.) S. Baron Hügel found it in Emodus.

Polypodiaceæ.

5. *Acrostichum angulatum*, S. Blume in Java.
6. ,, *decurrens*, (Desv.) Philippines and Nilagiri in *Wallich's herbarium*.)

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3. *Gleichenia Hermanni, Wall.* 4. *Osmunda Leschenaultii, Wall.*—Ed.

7. *Acrostichum stigmatolepis*, (Fée.) In Delessert's herbarium "from Nilagiri;" Perrottet.
8. *Leptochilus lanceolatus*, (Fée.) Perrottet in 1838.
9. *Hemionitis cordata*, (Roxb.) sent by S. and W. Hook. and Grev. ic. fil. t. 64. Rheede Hort. Mal. 12, t. 10.
10. *Gymnogramma totta*,(Schlechtendal). var: *mollisima*, (Kunze.) G. Schmidii, (Zenker's manuscripts.) } Very little different from that of Madeira and Abyssinia.
11. „ *bifurcata*, (Kaulfuss' herbarium.) sent by S.
12. „ *leptophylla*, (Desv.) sent by S. is smaller than the specimens from South Europe, Teneriffe, Madeira, Mexico, Egypt and Abyssinia.
13. *Ampelopteris firma*, (Kunze.) S. and Hügel, No. 2152.
14. *Grammitis attenuata*, Kunze.) S. Nov. species.
15. *Selliguea involuta*, (Kunze) Syn: Grammitis involuta, (Don, Blume, Hooker and Greville.)

„ var: *cuspidata*, Grammitis cuspidata, (Zenker's Plantæ Indicæ) sent by S. and W.

Synn: Loxogramma, (Presl.) Antrophyum, (Blume,) Fl: Jav: p. 87.

16. *Polypodium* (Pleopeltis,) *mediusculum*, (Kunze,) Nov. sp. sent by S. and W.
17. *Polypodium* (Pleopeltis,) sent by W.
18. „ *linearis* affine, S. also Nepaul.
19. „ (*Phymatodes*,) (Presl.) Nov. sp: S. W. *sterile.*
20. „ (*Drynaria*) *oxylobium*, (Wallich) S. W. in Nepaul, Wallich. in Emodus, Hügel.
21. „ (*Drynaria*) *quercifolium*, (Linn.) S.
22. „ *carpophyllum*, (Zenker's manuscript) S. W. Nov. spec.
23. „ *pyrrhorachis*, (Kunze,) S. W.
24. *Niphobolus sticticus*, (Kunze.) Nov. sp. S. W. Leschenault, also from Emodus.
25. „ ....spec. sterilie, S.
26. *Blechnum orientale*, W.

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21. *The true Linnean species, Fl. Zeylanica.*—ED.

27. *Asplenium* (*Actiniopteris*) *radiatum*, (Sw.) Syn: Blechnum radiatum, (Presl) S. Hook. Icon. t. 975.

28. „ *Zenkerianum*, (Kunze,) Nov. sp. S.

29. „ *falcatum*, (Retz) S. also in Ceylon and Java.

30. „ *decurrens*, (Kunze) Nov. sp. S.

31. „ *brachyotes*, (Kunze) W. also in South Africa.

32. „ *opacum*, (Kze) Nov. sp. W.

33. „ *camptorhachis*, (Kze) Nov. sp. S.

34. „ *emarginato-dentatum*, (Zenker's M.SS.) S. N. sp.

35. „ *umbrosum*, (Klfs.) W. also from Brazil, Martius.

36. „ *lunulatum*, (Sw.)

„ var: *sphenolobium*, (Kunze) S. W.

37. „ *fimbriatum*, (Kunze) Flora Af. Austr: Natal. Emodus.

„ var: *leptophyllum*, (Kze) S. W.

38. „ *furcatum*, (Thunberg, Kunze) S. W.

39. „ *tenuifolium* (Don) S. W. larger than the Natal form.

40. *Allantodia solenopteris*, (Kunze) S. W.

„ var: *pusilla*, (Kurr.)

41. „ *Fieldingiana*, (Kze) Nov. sp. S. Fielding received it from Emodus.

42. „ Species doubtful. W.

43. *Diplazium lasiopteris*, (Kze) W.

44. „ *nigro-paleareum*, (Kze) S. N. sp.

45. „ a juvenile, sterile specimen, the roots mixed up with one similar to Pteris Blumeana (Kze adds, I have not yet seen the like.)

46. *Pteris geraniifolia*, (Radd: fil: Brazil) S. W. also, Nepal, Chili, Java. Hook. ic. t, 915.

47. „ *Cretica*, (Linn) S. W.

48. „ *Blumeana*, (F. Ag.) S. W. (Pteris normalis, Blume, Java.)

49. „ *lanuginosa*, (Bory) S. also Mascarenhas.

50. „ *multi-aurita*, (F. Ag.) Leschenault on Nilagiri? grows in Ceylon.

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29. *Burm. Zeyl. t*, 43; *Rheed. Mal.* 12. *t.* 18.—Ed.

51. *Pteris palearia*, (Roxb :) S.
52. *Adiantum hirsutum*, (Bory) S.
53. ,, *aethiopicum*, (Kze.) S. W. At the Cape, Australia.
54. ,, *capillus veneris*,
    var : 1, *normale*, S.
    2, *latissimum*, (Kunze) also Bory in Algiers, and Hay in Emodus.

55. *Cheilanthes dealbata*, (Don) Nepal, S. Kurr.
    ,, *farinosa*, Hook and Grev :
    farinosa, var : pallida-sulphurea W. Kurr.
    Wallich in Nepal, Hay in Emodus; Hügel in Karli; Cuming in Luzon; Zollinger in Java.

56. ,, *bulbosa*, (Kunze) S. "valde insignis," similar to Ch : elegans (Desv.)
57. ,, *Dicksonioides*, (Endlicher) S. W.
    var : *phyllochlaena*, (Kze.)

58. ,, *resistens*, (Kze.) S. Nov. Sp.
59. *Lindsaea cultrata*, (Sw) S. W.
    var : *pallens*, (Wallich's Catalogue).
60. *Davallia tenuifolia*, (Sw.)
    ,, var : *B segmentis latioribus*, S. W.
61. *Nephrolepis tuberosa*, (Presl). S. W. also Bourbon, Java.
62. *Aspidium* (*Cyrtomium*) *anomophyllon*, (Zenker, Plantae Indicæ,) S. W.
    var : *macroptera* and *microptera*, but intermediate forms are not wanting.
63. ,, *atratum*, (Wallich) S. W.
64. ,, (*Nephrodium*,) *caudiculatum*, (Sieb.) W. Nov. Sp.
65. ,, ,, *Xylotes*, (Kunze.) S. Nov. Sp.
66. ,, ,, *ochtosis*, (Kze.) S. W. N. Sp. also near Mercara, found by the Revd. Mr. Metz, and sent to Hohenacker.

67. ,, (*Dicharium* A. B.) *Donianum*, (Spr.) S.
    ,, Syn. *Wallichianum* (Spr.) ,, paleaceum (Don.) patentissimum (Wall.) *Lastraea patentissima*, Pr. tent. Pterid.

68. *Aspidium Weigleanum*, (Kze.) W. Nov. Sp. (Nephrodium procerum, Don. prod. fl. Nep.)

69. „ (*Nephrodium*) *Canariense*, (Al. Braun) perhaps the same.

„ Syn *Aspidium elongatum*, (Willd. Sp. pl. R. Brown in H. Kew; Hook. and Grev. ic. t. 234.

70. „ („) „ a doubtful species. W.

71. „ („) *scabrosum*, (Kze.) Nov. Sp., S. W. (A tree fern ?)

72. „ (*Polystichium*) *palmipes*, (Kze.) S. W.

73. „ („) *brachypterum*, (Kze.) S. W.
var. *major*, *laxa*, S. Metz (in Hochenaker.)

74. „ („) *subinerme*, (Kze.) W. N. Sp.

75. „ („) *tacticopterum*, (Kze.) S. Nov. Sp.

76. „ („) *mucronifolium*, (Bl. ? Java) W. Hay on Emodus.

77. (over looked.)

78. „ („) *Wallichianum*, (Pr.) S. Syn. Asp. setosum,(Wall.) *Polystichum setosum*, Schott. Hooker's Asp. Wallichii and Sprengel's Asp. Wallichianum are both erroneous.

79. „ („) *parvifolium*, (Kze.) S. W. Syn. *Polystichum coniifolium*, (J. Sm.) Cuming, the specimens from the Philippine Islands are more robust.

CYATHEACEÆ.

80. *Alsophila crinita*, (Hook. ic. Plantarum t. 671.) S.

81. „ *latebrosa*, (Wall.) Penang, Assam.

„ var. *Schmidiana*, smaller than the normal form.

HYMENOPHYLLACEÆ.

82. *Trichomanes Schmidiana*, Zenker's MSS. (in Dr. Taschmer's Dissertation) similar to *Tr. filicula* (Hook) Nilagiris ? and still more to Tr. intramarginale, (Hook. and Grev.) ic. fil. t. 211. Perhaps a dwarfish form of Tr. Schmidianum, from Ceylon?

LYCOPODIACEÆ.

83. *Lycopodium aloifolium* (Wall. cat. 129) Spreng. monograph des Lycopodees, Hook ic, fil. t. 223.
84. „ *subulifolium*, (Wall. cat. 114) Perrottet.
Syn. *Lyc. Nilagiricum*, Spreng. 1, p. 58, n. 42.
85. „ *serratum*, (Thunberg); Spreng. Perrottet, also in Java, Japan.
86. „ *macrostachys*, Hooker's Herbarium, Spreng. 1. 1 II. p. 30, n. 496.
Syn? *Lyc. Phlegmaria*, Kunze's Herbarium, given by Koenig from East India, also in Ceylon.
87. „ *cernuum*, (L. Spreng. monogr. 1, 79) Perrottet and Kurr.
88. „ *clavatum*, (Linn. Spreng.) Hooker's Herbarium.
89. „ *Wightianum*, (Wall. cat. 2184, Syn. Lyc. sabinaefolium, Kunze) in fil. Zollinger.
90. *Selaginella vaginata*, (Spreng.) Perrottet.
91. „ *radicata*, (Spreng.) W. Perrottet.
92. „ *caulescens*, (Spreng.) W.
93. „ *pennula*, (Spreng. Voyage Bory.) Perrottet.
94. „ *tenera*, (Spreng.) Syn. Lyc. ornithopodioides, (Wall cat. 2186.)

CALICUT, 24th January, 1857. *B. SCHMID.

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* The Manuscript not being always legible, some errors may have crept into this interesting Catalogue.—ED. M. J.

VIII. *A List of Neilgherry Mosses.* *By* DR. B. SCHMID.

[These were collected by Mr. Perrottet, described and named by Montagne in 1842, others found by Dr. B. Schmid, described and named by Dr. Charles Müller of Halle in Prussia, in the Botanische Zeitung, 1852-54. Mr. Perrottet collected principally about Kaity, and at Neddoowuttam and Kotagiri. Dr, Schmid explored

exclusively in the basin of Ootacamund. The Mosses marked † were collected by Mr. Perrottet; those without a mark were collected by Dr. Schmid; those marked * were found by Mr. Perrottet and also by Dr. Schmid.]—Ed. M. J.

Class II. CLEISTOCARPI.

Tribe II. BRUCHIACEÆ.

Genus II. *Astomum.*

1. *Astomum denticulatum*, C. Müll.

Class III. STEGOCARPI.

Sub-class I. ACROCARPI.

Tribe VIII. FISSIDENTEÆ.

Gen. I. *Conomitrium.*

2. *Conomitrium serratum*, C. Müll, Synops. II. p. 527.

Gen. II. *Fissidens.*

3. *Fissidens Schmidii*, C. M. similar to F. crispus.

* 4. ,, *anomalus.* Montagne, Annales des Sciences Naturelles, 1842, No. 36.

Tribe XI. FUNARIOIDEÆ.

Gen. I. *Funaria.*

* 5. *Funaria hygrometrica*, Hedwig.

† 6. ,, *physcomitroides*, Mont. about Kaitie.

Gen. IV. *Entosthodon.*

* 7. *Entosthodon Perrottetii*, C. M. Kaitie.

8. ,, *diversinervis.* C. M. a very fine species.

9. ,, *submarginatus*, C. M.

Tribe XV. BRYACEÆ.

Gen. I. *Mielichhoferia.*

10. *Mielichhoferia Schmidii*, C. M.

Gen. II. *Bryum.*

*11. *Bryum Neilgherrense*, Mont. (Dr Schmid's specimens have larger nerves set.)

12. ,, *Zollingeri.* Duby.

†13. ,, *Montagneanum.* C. M. Brachymenium pendulum, Mont. Musc. Neilgh. No. 48.

14. ,, *apalodictyoides.* C. M.

15. *Bryum lamprostegum.* C. M.
16. ,, *porphyroneuron.* C. M.
17. ,, *rugosum.* C. M. a pretty, remarkable species.
18. ,, *exile.* Dz. et Molkh.
19. ,, *flaccidisetum.* C. M. a pretty species.
*20. ,, *argenteum.* L. very frequent on earth and wood.
21. ,, *Schmidii.* C. M.
†22. ,, *leptostomoides.* Mont. Dodabetta on Rhododendrons.
23. ,, *clavariaeforme.* C. M.
24. ,, *velutinum.* C. M.
25. ,, *trematodonteum.* C. M.

Tribe XVI. DICRANACEÆ.

Gen. VI. *Dicranum.*

26. *Dicranum involutum.* C. M.
27. ,, *nivale.* C. M.
28. ,, *flagelliferum.* C. M.
29. ,, *albescens* C. M.
†30. ,, *caudatum.* C. M.
31. ,, *tricolor.* C. M.
32. ,, *erythrognaphalon.* C. M.
33. ,, *Schmidii.* C. M.
34. ,, *nodiflorum.* C. M.

Tribe XVII. LEPTOTRICHACEAE.

Gen. VI. *Angstromia.*

35. *Angstromia phascoides.* C. M.
36. ,, *Schmidii.* C. M.

Gen. VII. *Leptotrichum.*

†37. *Leptotrichum plicatum.* C. M. humid wood behind Avalanche.

Gen. IX. *Trematodon.*

38. *Trematodon Schmidii* C. M. a pretty species.
39. ,, *paucifolius.* C. M. hitherto only found in Java.

Tribe XVIII. BARTRAMIACEÆ.

Gen. IV. *Bartramia.*

†40. *Bartramia Roylii.* C. M.
†41. ,, *macrocarpa.* C. M.
42. ,, *dicranacea.* C. M.

Tribe XIX. POTTIOIDEÆ.

Gen. VII. *Barbula.*

43. *Barbula orthodonta.* C. M.
44. ,, *Schmidii.* C. M.

Gen. VIII. *Ceratodon.*

†45. *Ceratodon stenocarpus* Br. and Sch. about Neddoowuttam.

Gen. XI. *Zygodon.*

46. *Zygodon acutifolius.* C. M.
47. *Zygodon tetragonostomus.* A. Br. Java, Blume.
48. ,, *cylindricarpus.* C. M.
49. ,, *Schmidii* C. M.

Gen. XIII. *Orthotrichum.*

50. *Orthotrichum Schmidii.* C. M.

Gen. XV. *Macromitrium.*

†51. *Macromitrium Perrottetii,* C. M. Kaitie.
52. ,, *squarrulosum.* C. M.
53. ,, *Schmidii.* C. M.
54. ,, *Neilgherrense.* C. M.
55. ,, *uncinatum.* C. M.

Gen. XXI. *Grimmia.*

56. *Grimmia Neilgherrensis.* C. M.

Class III. STEGOCARPI.

Sub-Class I. ACROCARPI.

Tribe. LEUCOBRYACEÆ.

57. *Leucobryum Neilgherrense.* C. M.

Tribe MNIOIDEÆ.

Sub-tribe POLYTRICHACEÆ.

†58. *Polytrichum (Catharinella) Neesii.* C. M.
†59. ,, *(Cephalotrichum) perichætiale.* Mont.
†60. ,, *(Pogonatum) microstomum.* R. Br. P. urnigerum Montg. in Musc. Perrottetii.

Sub. Class II. PLEUROCARPI.

Tribe. HYPOPTERYGIACEÆ.

†61. *Hypopterygium (Euhypopterygium) Struthiopteris.* Brid. Syn. II. 4.
†62. ,, (,,) *tenellum.* C. M.
†63. ,, *(Rhacopilum) Schmidii.*

Tribe. MNIADELPHACEŒ.

64. *Mniadelphus Montagneanus*. C. M.

Tribe. HYPNOIDEÆ.

Subtribe. NECKERACEÆ.

†65. *Rhegmatodon orthostegius* Mont. Kaitie on bark of trees.

*66. *Fabronia (Eufabronia) secunda*. Mont.

67. ,, (,,) *Schmidii*. C. M.

68. *Neckera (Euneckera, Rhystophyllum,) aequalifolia*. C. M. n. p.

†69. ,, *(Entodon) plicata*. C. M.

†70. ,, (,,) *Perrottetii*. C. M.

71. ,, (*Pterigynandrum*) *julacea*. Schw.

*72. ,, (,,) *Indica*. C. M.

*73. ,, (*Harrisonia*) *macropelma*. C. M.

74. ,, (*Papillaria*) *leuconeura*. C. M.

75. ,, (,,) *plicaefolia*. C. M.

76. ,, (,,) *breviramea*. C. M.

77. ,, (,,) *hispida*, *n. sp*. Dioica ?

78. ,, (*Pilotrichella Schmidii*. *n. sp*.

79. *Pilotrichum* (*Meteorium*) *punctulatum*, *n. sp*.

80. ,, (,,) *reclinatum*, *n. sp*.

†81. *Hookeria* (*Lepidopilum*) *Utacamundiana*. Mont.

*82. *Hypnum* (*Aptychus*) *subhumile*. C. M.

*83. ,, (*Taxicaulis*) *albescens*, Schw.

*84. ,, (*Isothecium*) *Buchanani*. Hook.

*85. ,, (*Pliacaria*) *Neilgherrense*. C. M.

86. ,, (,,) *paraphysale*, *n. sp*.

87. ,, (*Tamariscella*) *blepharophyllum*, *n. sp*.

88. ,, (,,) *pristocalyx*, *n. sp*.

89. ,, (,,) *tamariscellum*, *n. sp*.

90. ,, (*Hypnodendron*) *Schmidii*, *n. sp*.

†91. ,, (*Anomodon*) *consanguineum*. C. M.

†92. ,, (*Homomallia*) *secundum*. Mont.

(To be continued.)

IX. *Introductory Report on the Natural History of the Pearl Oyster of Ceylon.* By E. F. KELAART, M. D.

[This interesting Report is republished from the *Ceylon Overland Observer*, not only with reference to its intrinsic value, but also to its important bearings upon the Pearl Banks belonging to the Madras Presidency, which have long been in an unsatisfactory state.]—ED. M. J.

Having understood that some account of my researches into the Natural History of the Pearl Oysters of Ceylon, is desirable, even at this early period of my labours, I shall endeavour briefly to sketch a Report, that can only be considered in the light of an Introduction to a more extensive and prolonged series of observations; which, if means are afforded me, may be brought to a more speedy conclusion than I have any prospect of doing at present.

Before I proceed to detail the results of my researches, since I was commissioned by His Excellency the Governor, in March last, to undertake this desirable investigation, I have to acknowledge the great facilities which the *aquarium* gives, for the investigation of the natural habits of Molluscs, and other moderately sized fresh and sea water animals. Without glass aquaria and a powerful microscope, I should not perhaps have obtained even that information on the minute anatomy and habits of the Pearl Oyster, which is embodied in this Introductory Report. Soon after my appointment, I ordered out large glass aquaria and other apparatus, which will be of service hereafter, to myself, or to those who may be engaged years hence, in reporting to Government, from time to time, the natural condition of the Oysters in their various banks. In the mean time, I have made use of large glass globes and Ceylon manufactured aquaria, made of thick crown glass, Roman cement and slate, purchased from the Naval Store. Large chatties too, and tubs, are also in use. The Oysters thrive best in chatties, but these do not afford the same opportunity of seeing their habits as glass sided aquaria. I have also, in addition to the above named means of observation, had perforated wooden boxes, with a few Oysters in each, deposited in various

depths of the sea; and latterly, I have used large canoes (ballams) for the same purpose;—lastly, though perhaps of most importance, I have had unexpected facilities of observation among the several small beds of Oysters found in the inner Harbour of Trincomalie. They are found of all ages and sizes, and various depths and different kinds of banks; so that no Naturalist has perhaps ever had the same opportunities of observing the habits of the Pearly Mollusc, as I have at present.

I cannot do better, than correct at the outset, some popular errors regarding the anatomy of the Pearl Oyster; and this I may perhaps do most simply, by describing, in a popular form, the external and internal structure of the species of Mollusc producing the best Pearls of Ceylon.

The Mollusc, generally known as the Pearl Oyster, found in the Banks of Arripo, Chilaw, Trincomalie Harbour, and other parts of the Island, does not belong to the same *genus* as the edible Oyster of Europe, although, in its internal structure it has a resemblance to it. The Pearl Mollusc resembles more the Mussel tribe than the Oyster; more particularly, as it has, like the Mussel, a byssus or cable by which it attaches itself to foreign substances, or to others of its kind. The only source of information that I know of on this subject, available to the Ceylon student, is to be found in "Lebeck's Account of the Pearl Fishery of Ceylon, 1797," to be seen in the Appendix to Captain Steuart's book. The description Mr. Lebeck gives, is very imperfect, and excites a smile in the modern Naturalist; but this imperfection is excusable, in any account written in the infancy of the science of Conchology, and when the Microscope was scarcely ever applied to anatomical studies of shells; at least not in Ceylon. The most glaring error in that description is the mistaking of "bluish spots" on the foot for "eyes," and the "ovaria" for "lungs." This Mollusc has no eyes; and the lungs, or gills, are in the front, far away from the stomach, and occupy the middle space between the hinge and the anterior edge of the shell, easily seen when the valves are open; they look like four, or two pairs, of whitish (in a few specimens the gills are of a black color) semilunar combs or bands, stretched from side to side.

I have carefully examined Oysters of all ages, and have noted the structure of the shell, and of the animal within it: which will form the subject of illustration in a future Report. In this, I shall briefly describe the animal; as it is of the greatest importance, that a correct knowledge be first obtained of the animal structure, before a physiological account of its habits can be properly understood.

Meleagrina margaritifera, *Lamarck.*	Mytilus margaritiferus, *Linn.*
Pearl Oyster, ENG.	Avicula radiata, *Leach.*
Pintadine mere perle, FR.	,, margaritifera, *Sowerby.*
Mutu Chipi. TAM. & SYNG.	,, meleagrina, *Blainville.*

Conchologists have long agreed, that *Lamarck* was right in separating the " Pearl Oyster," *par excellence*, from the old genus *Avicula*, of which there are several species in Ceylon, some producing valueless pearls of a dusky blue and blackish colour. The only description of the Pearl Oyster of Ceylon I have access to, is Lamarck's, in his " *Histoire Naturelle des animaux sans Vertebres*," and that, too, is only of the shell.

" *Meleagrina, testa subquadrata, superne rotundata, fusco virente. Albo radiata, lamellis per series longitudinalis imbricatis, superioribus majoribus.*"—Lamarck, vol. 7, p. 107.

The Ceylon shell is a variety of that above described. The white radiating lines are alternated with rays of a red or black colour. Doctor Templeton made it appear, that the Ceylon variety corresponded with Leach's description of his *Avicula radiata.* I am more inclined to believe, that they are only accidental or occasional varieties. The shell however, appears to attain a larger size in America, and in the Persian Gulph, than in the Seas of Ceylon. In the largest Ceylon shells, the red or black radiating lines become obsolete. If they are permanent varieties, they are both found in Ceylon. I have a faint recollection of having seen both varieties on the Pearl banks of Arripo. I had also a small perfectly white Pearl Oyster; this may be an Albino specimen or Lamarck's *Meleagrina albina. M. testa albida, irradiata, obsolete squamosa; auriculis duabus semper distinctis*, originally found on the coasts of New Holland and Van Diemen's Land.

On removing the animal from the shell, the whole of the internal part is seen enveloped in a membrano-muscular covering, called the "*mantle*," and known popularly in Ceylon as the "*skin*." The free border of the mantle lining each valve, dips downwards, to meet with a similar veil on the opposite side; thus forming a kind of double fringed veil. The one set of tentacular fringe, in immediate contact with the shell, is composed of hairy tentacles, looking horizontally forwards; the other, about three-eighths of an inch apart from the former, and lining the edge of the mantle, from side to side, looks downward, and dovetails with the tentacles of the opposite flap of the mantle. These tentacles consist of a series of long and short flat filaments—the long ones having lateral filamentous projections. The tentacles are exceedingly sensitive; and one would almost give them the power of seeing; for not only the touch of a feather, but the approach of one when the animal is lively and in good health, makes them draw forwards, and perfectly shut out the intruder. As these molluscs have no organ of sight, I have no doubt that the delicate nerves which are distributed through the mantle and its tentacular processes, possess in some degree the sense answering to vision in other animals, as well as of touch; for an Oyster will be observed rapidly to close its valves on the approach to the aquarium of a lighted candle, or even the approach of a hand, or the shadow of a person, near the glass sides of a vessel in which it is confined. I should not, in a popular Report, advert to this physiological subject, but that the senses of the Oyster have a great deal to do with its habits, not only in the aquarium, but also in its native bed. Were it not for these delicate fringes surrounding the mantle, the softer parts of the Oyster would easily become the food of a host of carnivorous creatures abounding in the sea; and many more Pearls would drop out of the shell, than do now with such sentinels at the entrance of its external rim. The mantle is the only organ the animal has for the formation of the shell. The increase of the lateral dimensions of which, and the formation of the pearly nacre, and the Pearls, depending upon the condition of this important investment. If it is injured, the pearly matter is not secreted in such abundance over the shell, or if by some cause it becomes retracted

the shell does not grow rapidly, and the mother-of-pearl lining is jagged at the edge, and is not of the usual brilliant colour. However, its temporary retraction facilitates the ingress of sand and other irritating particles, which doubtless become the nuclei of many pearls, as will be hereafter observed. The forepart of the mantle is coloured and rayed like the shell. The colouring matter is secreted by glands found in these parts. The glandular secretion serves the purpose of increasing the lateral and longitudinal dimensions of the shell. It is after this is deposited, that the pearly secretion (nacre) is applied to the inner wall of the shell, which, concreting or solidifying, increases its thickness. The pearly fluid is secreted by nearly the whole external surface of the mantle. It will be thus clearly understood, that when a grain of sand or the larva of an insect is introduced between the mantle and shell, it will become covered over with the pearly secretion; which always going on, is augmented at the part where the foreign matter lies. This phenomenon I have detected with the aid of the Microscope in the very earliest stage.

About one and a quarter inch from the rim of the shell, is seen a pair of gills like four segments of a circle, or semilunar combs, stretching transversely from one side to the other, the convexity looking forwards. There is a vacant space between the concave surface of the gills and the body of the Oyster. The *adductor* muscle, called "*grizzle,*" is now seen, covered over with a delicate membrane. This muscle is attached to the inner surface of both shells. On one side (the left, when the Oyster is placed with the hinge next the observer) is seen a short, conical, tubular, sharp-pointed prolongation; this is the terminal end of the intestines; it looks like a sharp-pointed claw. The intestine is short: leaving the stomach, it winds round the *adductor* muscle, and terminates, as I have just remarked, on the side opposite to where the mouth is placed. There is always an unclosed space, between the edges of the mantle, when the tentacles are brought together, admitting of the free passage of excrementitious matter; and it was through the same opening between the mantle, that I observed, on one occasion, the ova escape, in a cloudy stream, which continued to pass into the water for nearly 15 minutes. I failed to detect the

immediate part of the animal through which the ova found their exit; and I have not been able to detect a regular oviduct. The ovaria, when distended with ova, cover nearly the whole of the stomach, heart, and liver, and project even on the conical cæcal process of the stomach, and also on the base of the foot. The stomach is very small, placed in the centre of the liver; the œsophagus is very narrow, scarcely admitting a moderate sized probe; it is about 3 lines long. The mouth situated near the hinge, behind the foot and byssus, is a horizontal slit, of about 3 lines in length, in the duplicature of the lower pair of labial palps. These palps are large, broad, truncated anteriorly, and rounded on the sides; the inner surface plaited, or rather grooved. The sense of feeling, or touch, is no doubt by this rugose structure, greatly increased. The palps serve the animal as organs of touch, if not of taste; they also serve to collect food, and give the animal the power of rejecting indigestible particles of matter, or such substances as might prove injurious.

I have, through the Microscope, ascertained the kind of food Pearl Oysters live on. This consists of minute algæ or weeds, animalcules and shells, called Foraminifera. *Diatoms* also, those minute vegetables forms which can scarcely be detected with the naked eye, are found growing on the external surface of the shell; where a host of infusorial and microsopical objects likewise find a pasturage. So that the Oyster may be said to carry on its back, the food upon which it lives. The siliceous internal skeletons of these Diatoms, I have detected in the excrementitious matter of the Oyster. It will be a subject for future inquiry, whether any of these sharp-pointed *skeletons* do not permeate the coats of the mantle, and thus become nuclei of Pearls. I have, on examination of "seeding" pearls found the skeleton of a *Navicula*, (species of Diatom) among the *ova;* but whether this proceeded from the stomach of the animal, or got there by passing under the mantle, it was not possible for me to determine.

The Pearl Oyster, like other Bivalves, (Conchiferæ) are Monœcious. or rather hermaphrodites; though, properly speaking, they can neither be said to belong to one or two sexes, for, with the exception of the presence of *ovaria* (or egg bags,) no other sexual

organ has been yet discovered. Doctor Johnson, in his valuable work on Conchology, remarks on *Conchiferæ*, "that every individual is sufficient to its own felicity." But however correct this may be, regarding the feeling of sexual gratification, it is clearly established by M. Rudolph Wagner, that in some Acephalous bivalves, as likewise in *Tunicata*, *Gasteropods* and *Polyps*, the ovaries of some individuals contain a milk fluid, instead of *ova* ; and that this milky fluid contains *spermatozoa* (seminal animalcules). I have now to add the Pearl Oyster (Meleagrina Margaritifera) as another of the bivalve species of Mollusc, which has individuals with spermatozoa or seminal fluid, in organs similar to those which in a larger number of individuals contain ova, or eggs. It will not, perhaps, be necessary further to discuss this important subject, than to remark, that the Native diver's idea, that "*there are male and female Pearl Oysters*," is not altogether fabulous. The important part which the male Oyster must play in the formation of banks of Oysters, is self-evident, if it can be clearly established, that the ova absolutely require the vivifying influence of a male fluid. I have not seen more than three or four individuals with this milky fluid, in 100 Oysters ; nor have I yet satisfactorily made out any difference in the characters of the shells of the two supposed sexes. The Native diver's opinion quoted by Captain Steuart and Mr. Lebeck, viz., that "the large flat ones they call males, and those that are thick concave, and vaulted, they call females, " Peedoo Chippy," is not borne out by my microscopical observations. I found well formed ova in Oysters which were broad and flat. It is quite possible, however, that in the course of this investigation, some external marks may be discovered, by which the male Oyster can be distinguished from the female. From the very small number of males (about 3 to 100) to females, I can easily fancy, that if by some natural or artificial cause, the males are destroyed, the banks will not be enlarged ; and that in time they will become extinct, i. e., supposing the majority of Naturalists are correct in their present view of the Diœcious character of Oysters. It is just as likely, that Mr. Garner's opinion will ultimately prevail ; viz., "that the organs called *ovaria*, do at certain periods, secrete the seminal fluid,

which impregnates the ova contained in them and is then discharged as an excretion by the oviducts." To this observation of Garner I have to oppose the fact, that not a trace of ova was seen in the ovaria of the supposed male Pearl Oysters, which were distended with the milky fluid at the time when the ovaria of other Oysters were distended with ova.

The last, though not the least important part of the animal, is the foot. This important member, which has so many useful services to perform in acephalous molluscs, requires a more than ordinary consideration. It is that long, brown, leech-like member, which is seen when the animal is at rest coiled up in a corner on the right side, above the byssus which, when protruding out of the shell, and moving about, gives one the popular idea of a tongue. It is of a dark brown colour above, and whitish beneath; in middle age it is speckled. It is composed of longitudinal and transverse muscular fibres, the latter interlacing between the former, which proceed in two columnar masses from each side of the *adductor* muscle; between the bundles or fibres, are placed the abdominal viscera. From its base is sent off, posteriorly, a glistening white fibrous band; this is attached to the duplicature of the mantle, near the angle of the valves. Thus, the foot is seen to be admirably adapted for locomotive powers; and also serves, by its connection with the *adductor* muscles, to lengthen or shorten the cable or byssus. The foot, in a full sized Oyster, is about two and a half inches long when extended; at rest, it is not more than one and a half inch in length. It is broad at the base, tapering, to a conical point; the upper surface is rounded and smooth, the lower flattened and grooved. The groove extending from the base, terminates at the point in an oval cup-like fosset. This groove is lined by a secreting membrane, and is an exact mould for the formation of the byssus, at the will of the animal. When it finds a necessity for making one, the foot is protruded out of the shell, and with the tip it seeks out a spot, where it can rest the terminal disc of the groove. If not satisfied with the substance or position of the stone or any other matter on which it rests, it removes to another more suitable spot; for a few minutes (say five or six, if the animal is strong) it rests, and is then retracted within the shell,

leaving behind a strong fibre with an oval disc, of the form of the groove in the foot. This whitish fibre is attached to the base of the foot at one end, and to the rock, or to the shell of another Oyster, at the other. In a day or two, this fibre becomes of a bronzed greenish colour, and looks like hair, with a broad flattened oval root attached to the rock. This process is again and again repeated, at intervals of a few minutes, till a sufficiently strong cable is formed. In a large Oyster, removed from the sea, upwards of fifty such fibres form a thick strong cable or byssus, which is attached to the base of the foot by a bifurcated fleshy root. The animal cannot detach the byssus from the rock to which it is attached, but it has the power of casting it off its own body and leaving it behind, (like a ship letting slip her cable and anchor in a storm, and sailing off to sea) in order to make another byssus, either on the same rock, or on any other convenient place.

I observed all this process in the aquarium at a very early period of my investigations; and was not surprised to find, that the Pearl Oyster having nearly the same organs as the Mussel, should form and reform its byssus. But I was agreeably satisfied in learning by these observations, that Captain Steuart, in his valuable and interesting Monograph on the Pearl Fisheries of Ceylon, was incorrect in denying to the Pearl Oyster this faculty. He states, that "*it is not believed that the Pearl Oysters have the power to detach themselves, or to remove at their own will.*" I have not only satisfied myself, and many friends who have seen the Oysters in the aquaria which I have established, that the Pearl Oyster can detach or unmoor itself, but likewise that it walks away with its foot foremost, and the shell behind; and does not, as Captain Steuart observes, "*move with its hinges in advance.*" This "shuffling" movement alone attracted Captain Steuart's attention, but it is an unimportant one; as all bivalves without a byssus have it, and it is independent of the will of the animal, owing to the valves being opened and closed for the purpose of respiration. How imperfect must Captain Steuart, a candid inquirer, now say, have been his long observations, when the Oyster is seen, night after night, taking a walk round the inside of a chatty, or mounting the glass side of a vivarium, forming, here and there, a byssus. It is most unfortunate, that he and

others should not have made these observations, (which are so simple in their nature, but yet conclusive of the possibility "*of translating Pearl Oysters from their original rocky beds to other more convenient locations.*"

Who can tell what the results might have been, had Dr. Wright's views been carried out? I know of my medical brother's Report (made I believe in 1803), only from the brief notice taken of it in Mr. Boyd's observations, and quoted by Captain Steuart, in the Appendix to his work (page 55). Mr. Boyd's observations clearly indicate, that Dr. Wright proposed, some thirty years ago, the transplanting the animals to places convenient for fishing them, when they arrive at maturity. Either Dr. Wright did not observe the facility with which the Oyster reforms its byssus; or he was misunderstood by Mr. Boyd, who remarks further on, "that surely as the animal has not the power of regaining its adhesion, after it is once detached, it cannot, when once broken away from its attachment, fix itself again, and must either perish, or be carried away by the current."

Now, it is very gratifying to me to be able to speak positively on this subject; and this I do hopefully, as I have observed the Pearl Oyster detaching itself spontaneously from its old moorings, in a glass vivarium and attaching itself to another part of the glass vessel, not once only but have noticed, that some Oysters will go through this process a dozen times, in less than a month. In addition to the above related facts, I have successfully established a colony of Pearl Oysters near Fort Frederick, in the open sea, at various depths; and have also Oysters which have been living for several months in wooden boxes, finger glasses, glass globes, chatties, and large canoes, sunk in the sea. Some were thrown into the sea, after being removed from the inner harbour and kept in my house in chatties and tubs for two and three days. The byssus of most of them had been broken and torn from the rock. These they have cast off, and are now living attached to each other, and to pieces of coral, and to rocks, exposed to all the influences of the sea.

When an Oyster is first put into a vivarium, it sickens, *i. e.*, the mantle becomes retracted, and a collapse is observed;—in a

few hours it revives, but with few exceptions, it is on the third or fourth day, that the portion of byssus attached to the foot of the animal is shaken or cast off, and the animal puts out its foot and forms another near the spot where it lies; or walks, by a snail-like motion of its foot, to, or up the side of the glass, to the level of the water, and there fixes itself. Some of the Oysters which were thrown into the sea, are now seen growing on the sides of rocks, four and five feet from the bottom.

I am not surprised at these results, for the edible Oysters, without a byssus, have been known for ages to bear translating with advantage, If Oysters in artificial beds in England can live and breed. I see no reason why the Pearl Oyster should not do the same, and like the edible Oyster, yield a large revenue; or prove remunerative to private individuals, who may undertake the establishment of new banks.

I have one other subject, connected with the interior economy of the Pearl Oyster, to report upon; and this the miscroscope which Government aided me in procuring, has enabled me to investigate very satisfactorily.

My observations commenced about the middle of March last; although I was not officially connected with the Ceylon Government till the first of May. I have ever since made monthly observations regarding the fecundation of Oysters; with the following results. In March, and all through April, May and June, every Oyster I opened, young and old, contained ova in the ovaria, except the few which had the seminal milky fluid; so that the *Meleagrina*, like the edible Oyster is in spawn almost from its birth, a precocity serving a useful purpose no doubt; and its practical bearing easily understood. From July to the present date, the Oysters examined did not all contain ova; some of the ovaria were only half full; others contained a very small quantity. It will be very interesting to proceed with these monthly examinations, and to ascertain, whether the Oyster is only in spawn at certain periods of the year; and, if possible, to determine whether it spawns more than once in twelve months. Nearly all the 100 Oysters from the Pearl Banks of Arripo, kindly sent to me by Mr. Vane, contained

ova, their form preserved, although saturated with arrack. Under the microscope the ovum is seen to be pear-shaped; each measured 3-1000 part of an inch in diameter, at its broadest part; longitudinally it is 6-1000 with a short pedicle attached. I have calculated, with the micrometer, the number of eggs contained in the ovaria of an Oyster of five or six years of age, and I find that there cannot be less than twelve millions. Leuwenhoeck states, that ten million eggs exist in one European edible Oyster. If we consider how few of these millions of eggs can arrive at the mature condition of a living Oyster, and the great demand that man makes upon the species for his gratification; we can only see in this great fact, the bountiful provision made by the Creator for a wise and beneficial purpose.

In concluding this first Report, I shall briefly recapitulate the important discoveries I have already made.

(*a*) The Pearl Oyster is more tenacious of life, than any bivalve Mollusc I am acquainted with. It can live even in brackish water, and in places so shallow, that it must be exposed for three or four hours daily to the sun, and other atmospheric influences.

(*b*) That it has locomotive powers, beyond any idea which can be formed from former observations.

(*c*) That the power of moving from place to place, is inherent, and absolutely necessary, in early life, for the due performance of the animal functions. This is obvious from the fact, that if a cluster of young Oysters stayed permanently in one place, adhering to each other, the growth of the animal, and particularly of the shell, would be prevented.

(*d*) That the Pearl Oyster will move about in search of food, if the locality, in which it is originally placed, is not rich in its natural supplies.

(*e*) That it will move from its original situation, if the water becomes impure, either from the decomposition of vegetable or animal matter, or muddy; and, probably too, if there is a large influx of fresh water.

(*f*) That if the water is agitated to an inordinate degree, the Oyster will leave its old mooring place and seek another.

(*g*) That a thunder storm will kill some in an aquarium. (Query,) Have thunder storms similar fatal effects on Oysters lying deep in the sea?

(*h*) That the animal can unfix itself from its byssus; and that crabs, shrimps, and other creatures, force them to form a new byssus, by nibbling through the old one.

(*i*) That it can re-form its byssus at pleasure, if in good health and condition.

(*j*) That it can live for a long time, without forming a byssus; and that it will re-form a byssus when it has recovered strength.

(*k*) That the power of re-forming its byssus, is not to confine the young animal; but that the largest living Oyster I have seen, can re-form it in an aquarium, as well as in the depths of the sea, but not so actively as the young and middle aged.

(*l*) Pearl Oysters are gregarious in their habits. In placing several young Oysters in different parts of an aquarium, they will sooner or later be found attached to each other. The older ones have also this desire; but their heavy shells impede their motion, and they are contented to remain apart from their fellows.

(*m*) That taking the foregoing facts into account, there appears to be no reason why Pearl Oysters should not be translated from their native beds, and made to colonize other parts of the sea.

(*n*) That the young, as well as the old, are in spawn from March to September; and that probably there is no stated period for spawning.

The whole occupation of the Oyster, when fixed to a spot, appears to be, keeping its valves open, and admitting food to its mouth. For several hours the valves remain open, they then close for a few minutes, or for an hour or two, then open again. At night, the valves remain generally open till towards daylight, when they close, and remain so till the sun shines brightly over the horizon. It is during the early part of the night, or soon after sunset, that they exercise, *when required*, their locomotive powers. I have watched the Oysters in aquaria for nearly a whole night;

and they appear to be then active in moving and attaching themselves to new localities. During the day, I have only seen, on one occasion, an Oyster form a new byssus. This nocturnal habit, is doubtless instinctive precaution; for should Oysters move during the day, they are more likely to become the food of fishes, and other animals which prey upon them. Their movements are instinctive, and guided by the sense of touch. Darkness suits them better than daylight, of the difference of which they are very sensitive.

Most of the Oysters in which I have found Pearls, had external marks of having been retarded in their lateral growth, and displaced in early life from their fixed position on a bank. I am inclined to believe, that Oysters which have abundance of food, and are not disturbed, remain fixed for the last two or three years of their growth to one spot. These are less likely to have a large proportion of pearl bearing individuals among them. This of course requires more extensive practical observation, either on the beds in the harbour of Trincomalie, or on the Pearl banks of Arripo.

With reference to the formation of Pearls, I have nothing new to add to the accounts found in the best modern books on the subject; except that one, which modifies the view taken by Sir E. Home; viz. that Pearls are formed from abortive ova. I believe the ova left behind in the ovaria, are not the nuclei of Pearls, but that the ova which escape through the distended coats of an overgrown ovarium, and are imbedded in the interstices of the mantle, become nuclei of Pearls formed in this situation. I have repeatedly examined seed, or young pearls, in process of formation; and with a magnifying power of 1·5 inch lens, I was able to see distinctly, the outlines of two and three ova through the first or superficial layer of nacre, surrounded by groups of ova. It can be readily understood how an overcharged ovarium will, by some accident, or spontaneous evolution, have its coats ruptured, allowing the ova to escape and become inserted in the contiguous attenuated parts of the mantle. As Pearls are more usually found imbedded in the mantle near the hinge, the most likely place where the ovarium is liable to rupture, I consider this very conclusive of the new theory I have here proposed. I may also observe, that I

have seen the vestiges, or cicatrices, in the mantle where the Pearls once existed. Though Pearls originate in the mantle, when large they work their way out, and lie loose between it and the shell; or become attached to the "Mother-o'-Pearl" surface of the latter. I have no doubt that Pearls can work their way out from this position, and be found entangled in the meshes of the byssus. I also consider it very possible, that an over-distended ovarium is one of the causes of Pearls being discharged from the Oyster and lost. If this be really the case, it will easily account for the singular fact, that a sample of Oysters, fished in the month of October, will yield a larger proportion of Pearls, than a batch of Oysters fished from the same bank in the months of April and May of the following year. These observations are somewhat suggestive, and can be improved upon by future investigation.

I have now drawn to a conclusion this Report, which, I fear, has extended to a greater length than will suit the patience of the reader. But the subject being one which has been so long neglected and so little understood, I hope that the Government which has engaged my services, if they do not consider my endeavours as already productive of some practical results, will, at least, see in these researches, glimpses of future success. It is due to Sir Henry Ward, here to acknowledge my grateful thanks, in which my brother Naturalists in all parts of the world, I am sure, will join for the gracious manner in which my humble services have been retained, for investigating, fundamentally and practically, the Natural History of a species of Shell, which from the darkest ages of the world to the present, has been considered of inestimable value in producing one of the richest of gems. Time was, when the product of Pearl Oyster fisheries founded cities in South America and the Red Sea. But what is the state of the Islands in the Red Sea, "whose merchants were princes"? They are now thinly inhabited by a miserable race of fishermen. The sites of some of the Oyster banks in South America are not even now known; they have been destroyed by being overfished. New beds are doubtless forming in localities to be yet known to future generations. Ceylon Pearl banks were once on the point of sinking into the same state, but for the subsequent observance of more caution. I was present

at two of the largest fisheries ever made off Arripo in 1835 and 1836. The Oysters fished during the first half of the fishery were full sized, and yielded a good price, most of the speculators making handsome profits. Government was encouraged to pursue the fishery; young Oysters were taken up; many of the purchasers, inflated with former gains, purchased readily, and were ruined; and, I believe, to this day, these over, or prematurely fished banks, have not been very productive, although twenty years have since elapsed. If the same incautious and unscientific plan were adopted on the Oyster banks in England, similar results would soon be perceived there. Not a "native" would be had in London, nor even a cultivated one seen any where. If Government desires to have a steady, and not a precarious revenue, from Pearl Oyster fisheries, let good laws protect the beds already known, and those that are now forming; and let means be adopted to secure their increase and growth. In one year more Oysters are consumed in England, than were fished on the banks of Arripo last year; and this consumption is repeated year after year, without exhaustion; simply because the natural laws having been once found out, they are allowed to operate fairly. It will indeed be a very great source of satisfaction to me, if any of the natural laws I have described in this Report, suggest to Government, an improved system of management.

My attention has also been directed to the Natural History of the Tamblegam Oyster, *Placuna placenta.* I have a few still alive, which were translated in May last. If this Oyster can be successfully translated, the whole of Batticaloa lake might be converted into a large Ostrearium. The *Placuna placenta* has no byssus, and can, therefore, be more readily transported. Their removal from their native beds, does not necessarily destroy the internal parts. About one-third of the Pearl Oyster (*Meleagrina,*) die from being injured by the force necessarily applied when detaching them from the rocks to which they adhere.

I have also lately "*doctored*" some Pearl Oysters, according to the plan adopted by the Chinese, in the case of the large fresh water mussel; but which method, I believe, has never been attempted with the real Pearl Oysters. Time, and further experi-

ence, are required, to ascertain the results of this practice in Ceylon. Dr. Gray, of the British Museum, has, I believe, by the application of the same means, succeeded in producing Pearls in the edible Mussel or Oyster of England. It may therefore be hoped that I shall eventually succeed with the Pearl Oyster of Ceylon. All that I can at present say, is, that they do not die under the operation, and that they are still living, having also reformed new byssuses. This is the only way the period required for the formation of good sized Pearls can be ascertained. There are some other points in the natural habits of the Pearl Oyster, which I reserve for future Reports, as precipitate conclusions may mislead the Government.

X. *Report on the Tamblegam Pearl Oyster Fishery. By*

E. F. KELAART, M. D.

The Oyster found in the Tamblegam lake, and from which Pearls are obtained, is the *Placuna placenta*, "Vitre Chinoise" of some French writers, and the "Window Oyster" of English travellers in China—the shells, from their semi-transparency, being used for windows. The *Placuna* belongs to the same family of Conchiferous Molluscs as the edible Oysters of Europe and of this country. It has no resemblance (except slightly in the animal structure), to the shells of the Arripo Oyster (*Meleagrina.*) When full grown the valves (shells) measure, at their broadest transverse diameter, from 5 to 7 inches; and their longest longitudinal diameter is about the same; some, half an inch more. They arrive at maturity sooner than the *Maleagrina margaritifera*, and like the Aripo Pearl Oyster, the young also have ova. I am not able from my own observation (having been only a few months engaged in these researches) to say, in how many years this Oyster arrives at perfection.

But from the appearance of shells of all sizes, and the history of the Tamblegam Pearl fisheries since 1839, I should say, that in three years, this bivalve Mollusc attains its adult age; and, that after that, it dies. It appears to thrive best in brackish water, but a large influx of fresh water (from rivers) kills them. Instances have been known, when a large number of young and old Oysters died in Tamblegam lake, during some very rainy seasons when the rivers which empty into the lake brought down an unusual quantity of fresh water. If ever the channel, which was once proposed to be cut through the neck of land which connects the lake with the Trincomalie harbour, is made, this cause of mortality will more rarely occur, perhaps never again exist.

From the flattened formation of the shells, Pearls are very liable to drop out when the animal reaches its full growth; I would therefore fix, as the best period for fishing, the time when the animal has closed its supposed two year's age, or when the shell measures from 5½ to 6 inches in transverse diameter.

I have inspected the Tamblegam bank this week, and am sorry to report, that there is no prospeet of even an average good fishery before the middle of 1859. The banks have been overfished. The Natcha Cooda bank is completely destroyed. The renter in 1856, left scarcely any Oysters behind, and this portion of the bank will consequently be unproductive for many years, possibly yield none again, unles Government should re-stock it.

Nothing could have been more prejudicial to the interests of the Government, than to have leased out the bank by the year. The Government Agents who could have acted so unwisely as to lease out to Native renters a small bank of Pearl Oysters for three consecutive years, without any stipulation as to the *size* of the Oysters to be fished, must have lost sight of the natural laws of reproduction and multiplication of species, known even to the Native divers. It is therefore very gratifying to observe, that the present Government Agent, Mr. Morris, takes great interest in my researches; that he is alive to the importance of the Naturalist's opinion, and has recommended that all young Oysters be thrown back into the lake; a measure which I had the opportunity of sug-

gesting to his Excellency the Governor in March last, but which, I believe, was only partially acted upon, during the last Pearl fishery at Aripo.

I watched the number of Oysters fished during the two days I was lately at Tamblegam (Keenear), and have to report, that there could not have been less than 30,000, on each day. More than two-thirds of this number were young, and had better have been left in the lake for another year or more. The renter is evidently making the most of the few months he has yet liberty to fish or *rather ruin the bank.* The Tamblegam Wanniah, and all the divers, whom I questioned on the subject, stated that in the early part of the present year, more than 50,000 Oysters were fished daily. It is therefore impossible to arrive at any other conclusion, than that the former renters misrepresented the state of their finances, from the Pearl banks, when they got Government to remit some portion of the rent, and had the fishery resold for a smaller sum, to another Native,—a relative, I am informed, of one of the original renters.

All Oysters are very prolific, and the *Placuna* is not an exception to the rule; for, at the lowest calculation, in three years, there must have been fished from this bank, upwards of 18 millions of Oysters, supposing that there were *only* 200 fishing days in each year. The renters' share must have been (allowing five shillings for each thousand Oysters) nearly £2,250, from which, deducting the three years rent, viz. £901, they must have derived a profit of at least £1,250. To this profit must be added another source of gain, (a very ingenious one) from the divers' share of Oysters. The diver is allowed half the quantity fished, but he is not permitted *to sell* the Oyster at the best market, or to the highest bidder. He is obliged to open the Oysters when fresh, and sell to the renter all the Pearls, at a fixed rate, which the renter takes good care shall be below the market value. Any plan therefore, which may relieve the diver of this grievance, will, I am sure, be thankfully welcomed by at least 20 individuals, whose chief means of living is by diving for Pearl Oysters.

Oysters of upwards of two years of age, (i. e. about six inches broad) are worth *at least* ten shillings a thousand, but if there is

any competition, they may be sold for even fifteen shillings a thousand; for although the Pearls they produce are about two-thirds less in value than those from the Aripo Pearl Oyster (*Meleagrina*), the quantity obtained in 1,000 Oysters, is at least three times more than what is obtained in a similar number from the Aripo banks.

Upon these circumstances, I have to submit for the future guidance of Government, the following proposals:

1st. That the banks be allowed to remain undisturbed for eighteen months after the termination of the present fishery.

2nd. The future fisheries to be conducted by Government Officers, and the Oysters sold to the highest bidder.

3rd. That the fishery be held only for two or three months in the year; say April, May and June, and that a sufficient number of boats be employed daily, so as to have the matured Oysters during this fishing period.

4th. That the banks be carefully watched, and placed under the immediate supervision of the Tamblegam Modliar, to whom a per-centage might be promised on the net profits of each fishery which yields to Government more than £500. I suggest this per-centage, well knowing, that any extra work thus thrown upon a Native official, will be badly performed, unless paid for according to the value of his labour.

5th. That no Oyster under 5½ inches broad, be allowed to be removed from the banks.

6th. That a fourth share of the Oysters fished be *boná fide* the divers' share, which they shall be at liberty to dispose of to the best advantage for themselves.

7th. That those parts of the Tamblegam lake which have been denuded of Oysters by over-fishing, be re-stocked with young Oysters, found in the shallow parts of the lake, or near its margin; which if left in their present position, are very likely to be clandestinely removed at night, although the banks may be strictly watched.

8th. That Government endeavour to fish up the Oysters by dredging, instead of the present pernicious method of divers walking over most parts of the banks, searching for them with their feet; by which means, they crush the young Oysters and destroy the spawn.

This Oyster, having no byssus, is not attached to any hard substance; nor is it cemented, like some of the edible Oysters, by the hinge, or by one of the valves, to any subject, but lies either flat on the mud, or is fixed loosely in a semi-vertical position, with the wedge-shaped hinge buried in the mud. It follows, therefore, that they can be removed with great facility with the ordinary Oyster dredge.

The young Oysters taken by the dredge can be returned immediately to the lake; or collected and then deposited in some suitable place, previously selected by the supervisor.

I have no doubt, in my own mind, that by proper supervision and care, the Tamblegam lake Oyster Fishery, may be made to yield in a few years, at least £1,500 every second year. For the last 18 years, the average annual revenue to Government was only £344.

In order to secure this revenue for future years, it is necessary that the present renter's proceedings be watched; and, that he be obliged strictly to observe the condition of his bond, viz: "That the Fishery of the said Pearl banks shall be *carefully* and *prudently* carried on by the Renter and others, his servants, so as to cause no *damage* or *injury* to the said Pearl banks."

If, in the opinion of the Government, the above condition does not enjoin the renter to prevent divers taking up *young* Oysters, I think it will be worth while to pay him £50 or more, and take his lease from him; for at the rate he is now fishing, and bringing up daily 5,000 or 6,000 young Oysters, scarcely more than eight months old, and which cannot yield more than six-pence worth of Pearl in each thousand, even if they do that, the bank, which now promises to give a tolerably good fishery in June 1859, may, like the Natcha Cooda bank, be unproductive for many years. I would therefore suggest, that a Government Officer be immediately sent to the fishery to prevent further mischief being done.

I cannot help again observing in this Report, that it is worthy the attention of Government, to stock the various salt lakes of Ceylon with this species of Oyster. The lakes of Calpentyn, Putlam, Batticaloa and Hambantotte, if stocked with the "Window Oyster," will yield a very handsome revenue. I have availed myself

of the present opportunity to remove about 1,200 middle-aged Oysters (which the renter gave me) to *Yard Cove* in Trincomalie harbour, where the muddy bottom promises to be suitable for breeding them. But the experiment should be made on a larger scale, to test the full value of translating these Oysters to new localities; this I am not able to do from want of funds to meet the necessary expenses. I have already, in my former Report on the Natural History of Pearl Oysters, reported, that some of the Oysters, which were placed in other parts of the sea in May last, are still living.

SELECTIONS.

On a true Parthenogenesis in Moths and Bees; a Contribution to the History of Reproduction in Animals. By CARL THEODOR ERNST VON SIEBOLD, Professor of Comparative Anatomy in the University of Munich. Translated by WM. DALLAS, F. L. S., &c. &c. London: Van Voorst. 1857. 8vo, pp. 110.*

Among the many revelations of modern science, few have attracted more attention, or excited greater interest among naturalists, than the phenomena of Parthenogenesis; whether, with Owen, we regard this term as the appropriate designation of the alternation of dissimilar generations; or, with Siebold (and this, in our opinion, is the more correct), we restrict its application to the production of offspring "sine concubitu" from perfectly formed mothers. With regard to the former, Chamisso, as early as the year 1819, found in the Salpæ (a group of tunicated molluscs) that many species which are associated in long chains give birth to insulated individuals, which in their turn produce concatenated offspring; and these remarkable observations have been confirmed

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* Dublin Quarterly Journal of Medical Science, May 1857, p. 403.

by all who have examined these and kindred forms ; and from the researches of Sars, Steenstrup, Siebold, and others, we arrive at the conclusion, that, in many of the forms of lower existence, animals produce offspring, which at no one time of their development resemble their parents ; but which, however, in their turn bring forth a progeny which revert in their form and nature to the parent animal, so that the maternal animal does not meet with its resemblance in its own brood, but in the descendants of the second, third, fourth, or even more remote degrees of generation ; and this has been proved to be the case in many of the Medusæ, Claviform Polypes, Salpæ, many Entozoa and Aphides ; and, according to the assertions of some naturalists, in all the lower classes of animals ; so much so, that we cannot avoid inferring that many animals described as belonging to distinct species are but the alternate generation of known forms. The phenomena of alternation of generation differ essentially from metamorphic changes ; in metamorphosis we have changes taken place in the same individual ; while in alternation of generation, or metagenesis, different and many individuals arise and are separated from the parent ; besides, in the course of metagenesis, in many instances metamorphosis also takes place. In metagenesis we observe that in one alternation are produced distinct ovaries and ova ; in the others the development does not take place from ova, but by a process of gemmation ; and in the isolated Salphæ, a remarkable organ (*Stolen proligerum*) has been described, whence are developed the catenated offsprings.

These facts have gone far to solve a difficulty felt by some opponents to the " development theory ;" it has been stated by the ingenious author of the " Vestiges," that if animals have not been developed since the creation, our first parent should have had deposited in their structure either all the human entozoa or their ova. The phenomena of metagenesis, however, may lead us to infer, that all human entozoa may be but alternate forms of those animals found in other creatures or elsewhere, and this is actually the case with one entozoon (*Cysticercus fasciolaris*) which in one form is found in the cat, in another in the rat or mouse. In true par-

thenogenesis, phenomena of a totally different nature are exhibited —phenomena, the belief in the occurrence of which, did it rest on individual or questionable testimony, would gain but slight assent among the learned, but when we find such an array of names of naturalists who have mainly contributed to the advancement of natural science, all bearing testimony to the facts as related by Siebold, we cannot withhold our belief, that in many cases perfect offspring can arise "sine concubitu," from animals fitted for a union of the sexes, and that in one species of insects at least the sex of the offspring depends on the entrance of spermatic filaments into the egg.

In the study of this most interesting work, we are struck with the circumstance, that science is often retarded by general or sweeping assertions, although emanating from high authority. When Castellet, in 1795, reported to Rèaumur, that he had found that a moth of *Bombyx mori* (silk-worm) laid perfect eggs, though unimpregnated, he received the laconic reply—"ex nihilo nihil fit." How different in a similar case was John Hunter's reply— "But did they hatch?" for naturalists have not long been familiar with the circumstance that unimpregnated females will sometimes lay eggs; but these have hitherto been supposed to have been invariably incapable of being developed into a perfect animal. A common example of this is the occurrence of pullets' eggs, but these are notoriously incapable of being developed by incubation. At first blush we might be led to infer that reproduction without fecundation was impossible, so contrary does it appear to the usual course of nature, both in the vegetable and the animal kingdom. We observe what careful precautions are taken that the spermatozoa should reach their proper nidus uninjured: how many provisions are found to hedge around the safety of the pollen! Exceptional cases, however, do occur in the vegetable kingdom. The Cælebogyne, for instance, a diœcious plant from Australia, has produced fertile seeds at Kew, although the female only is known to botanists; and M. Lecoq had deduced from some experiments of his own, that similar phenomena occur sometimes in hemp, spurge, &c. Our author seems to have been fully aware of the

great caution required in carrying on an investigation of this kind, and to have devised his experiments accordingly.

In his introduction, he describes the seminal receptacle found in female insects. The existence of such a receptacle in bees, explains how it is that a queen, fertilized by a single coitus, after discharging a number of eggs in the first year, may again, in the following year and still more subsequently, lay eggs capable of development, because the seminal filaments are preserved in this receptacle uninjured, and in a quantity sufficient for successive broods. Siebold reviews at length the cases of alleged true parthenogenesis or "Lucina sine concubitu," which are to be found recorded by many observers, and shows that errors may have occurred in the observation of these cases; one of the earliest on record is that of Albrecht, who in 1701 wrote a treatise—"De insectorum ovis sine prævia maris cum femella conjunctione nihilominus nonnunquam fœcundis." He took a brown pupa, which he preserved apart, and yet the moth evolved therefrom laid fertile eggs. He says:—"Cum masculum huic papilioni haud adfuisse certus essem, et propterea ejus ova subventanea et sterilia esse judicarem, vix amplius eorum habui rationem relictis interim iisdem oscitantius et sine omni curh sub dicto vitro per totum tempus hyemale." Dr. St. Blancard is stated, too, in 1696, to have had a spider which for four consecutive years laid eggs from which young spiders escaped, "although no male spider had ever appeared in the business." Dumeril, Bernoulli, Treviranus, Burmeister, and others have made similar observations, but in all these instances the possibility of mistake has been shown by Siebold. This author then enters upon experiments which he performed on some sac-bearing Lepidoptera, particularly *Solenobio lichenella* and *triquetrella*, and by taking every precaution he convinced himself, and doubtless his readers also, that true parthenogenesis occurred in Pyschides. Examples in the honey bee next came under his notice, and in these investigations he was greatly assisted by the distinguished apiarian, Dzierzon. From accurate observations of the habits of bees, as well as from careful dissections, Dzierzon arrived at the singular conclusion, that drone eggs require no fecundation, and that true parthenogenesis is normal in these insects.

In the "Bienenzeitung" of Eichstadt, 1845, he thus expresses himself:—"Presupposing what will be referred to and proved in the following numbers, that the queen (female bee), to become good for anything, must be fertilized by a drone (male bee), and that the copulation takes place in the air.—I express the conviction, from which all phenomena and mysteries may be perfectly explained, that the drone eggs do not require fecundation; but that the co-operation of the drones is absolutely necessary when worker bees are to be produced." Again—"In copulation the ovaries are not fecundated, but the seminal receptacle, that little vesicle or knot, which in the young queen is filled with a watery moisture, is saturated with semen, after which it is more clearly distinguishable by its white colour; the activity of the ovaries in the normal state commences only after copulation, but it is not necessarily caused thereby; hence many unfecundated queens lay no eggs at all, while others lay only drone eggs; and even workers do the latter, although, from their want of a seminal receptacle, I regard them as quite incapable of copulation. I am convinced that such eggs are sufficient for the production of drones, whilst the egg from which a queen or worker is to be developed must come in contact with the seminal receptacle." In another place he thus writes:—"The queen has it in her power to deposit an egg just as it comes from the ovary, and as the unfecundated mothers lay it; or, by the action of her seminal receptacle, to invest it with a higher degree, a higher potency of fertility, and awaken in it a more perfect being, namely, a queen or worker."

Baron v. Berlepsch, of Seebach, has also contributed much to establish this theory of Dzierzon and by liberally placing his hives, furnished with Dzierzon's moveable comb-supports, at the service of Siebold, enabled the latter fully to confirm Dzierzon's views. Baron v. Berlepsch also performed three *experimenta crucis:* in the first he contrived the exclusion of a queen at the end of September, when there were no longer any males, and this queen, early in the ensuing year, furnished 1500 cells with a drone brood, the subsequent accurate dissections of Leuckart proving that this queen was a virgin. The second experiment exhibited considerable ingenuity. Knowing that a high or a low tempera-

ture causes the movements of spermatozoa to cease and become inert, he subjected a queen to a very low temperature in an ice-house; she recovered, and afterwards laid thousands of eggs, yet from all these were only males evolved. The third experiment was performed with the crossing of Italian and German bees. These, although of the same species, are found to differ most remarkably in appearance and disposition, and in the mixed breed which resulted, the drone offspring without exception presented the same variety as the queen-mother, thus affording a very strong negative proof that drone eggs do not require the interposition of the male bee. This matter has, however, been subjected to further proof by Leuckart and Siebold, for they examined freshly laid eggs, and in numerous instances they detected spermatic filaments in or on worker-eggs, while none could be found in drone-eggs. The experiments of Siebold upon this point seem to have been conducted with great nicety and care. He says:—

"I soon convinced myself that there was no possibility of discovering the delicate seminal filament between the granulo-vesicular yelk-masses, the linear object to be sought for was too subtle to be capable of discovery with certainty amongst the many mutually-crossing outlines of the yelk vesicles; after various vain endeavours to render the interior of the bee's egg accessible to an inquiring eye, I came at last to the idea of employing an artifice which I had soon acquired by practice, and which allowed me to survey at least a portion of the inner space of the bee's egg with great clearness an tranquillity. I crushed a bee's egg quite gently with a very thin glass plate, and so that it was ruptured at its lower pole, opposite to the micropylar apparatus, and the yelk gradually flowed out at this spot, by which a clear empty space was produced at the upper pole within the micropylar apparatus, between the egg-envelopes and the yelk which was retiring downwards."

Having thus microscopically examined the new-laid eggs of bees, he arrives at the following conclusion:—

"Amongst the fifty female bee-eggs examined by me with the greatest care and conscientiousness, thirty furnished a positive result; that is to say, in thirty I could prove the existence of seminal filaments, in which movements could even be detected in three eggs; of the other twenty eggs, twelve were unsuccessful in their preparation."

There was some difficulty in procuring drone-eggs for the purpose of examination, as the season was late ; however, as Baron v. Berlepsch spared neither trouble nor his hives (of which he had 104 in his bee colony), twenty-seven drone eggs were procured, and of these the author states :—

"I examined these twenty-seven drone-eggs, which might have been about twelve hours old, and which agreed perfectly both in their appearance and organization with the female eggs, with the same care and by the same method, with which I had treated the female eggs, and *did not find one seminal filament in any single egg*, either externally or internally."

Three of these only were unsuccessfully prepared, and the same queen, both before and afterwards, laid eggs from which worker bees were developed.

In the latter part of his work, Siebold enters on the consideration of the occurrence of true parthenogenesis in the silkworm moth, and details some very interesting observations on these insects. On a patient review of this subject, we can hardly withhold our assent from the propositions laid down by the author, and these views are considerably enforced by the strange facts detailed by other observers in regard to the prevalence and the absence of one or other sex among insects. Leon Dufour has stated, for example, that he never obtained a male insect of *Diplolepis gallæ tinctorum*, of the genus *Cynips*.

A priori we should say, that this was a topic from which we could expect nothing of practical utility of industrial application, and yet we are told that Dzierzon and other in the bee colonies have turned it to material advantage.

[The importance of the results contained in Von Siebold's work, induced Professor Goodsir, of Edinburgh to communicate an abstract to the Royal Society. Mr. Dallas, soon afterwards published an able translation of the work itself.]—Ed. M. J.

On a mode of protecting Timber from Fire. *By* Mr. ABEL.

[This Valuable Memorandum is specially worthy of the attention of Residents in Burmah and the Tenasserim Provinces, where the frequent occurrence of fire has proved so destructive, and where any arrangement insuring protection against the conflagration of wooden or thatched buildings would be most important.]—ED. M. J.

From F. A. ABEL, ESQ., *Chemist of the War Department, Woolwich, S. E.*, 30*th July* 1857; *to the Secretary East India Company.*

I have the honor to address you upon a subject which I have been strongly recommended by Colonel SANDHAM, Commanding Royal Engineer at Chatham, to bring to the notice of the Honorable Court of Directors of the East India Company.

During the late War, I was called upon by the Engineer authorities to suggest some simple, cheap, and efficacious means for protecting wooden hutting from fire, and at the same time, I was instructed by the Secretary of State for War, to examine into the merits of certain proposals laid before him for the same purpose.

The result of my experiments on this subject was the preparation of a protective material applicable even after the erection of huts, in the same manner as whitewash, tar, or paint, and which was shown to afford such important protection to wood in case of fire, that experiments upon a proper scale were ordered by Lord PANMURE to be tried at the principal camps in Great Britain, and, at the same time, permission was given me by his Lordship to patent the material of which permission, however, I declined to avail myself.

It was subsequently arranged by the Inspector General of Fortifications, that a full trial of the value of the material should be made by Colonel SANDHAM and myself at Chatham. The accompanying abstract from the professional papers of the Royal Engineers contains a copy of our joint report to Lord PANMURE on the results of these experiments to which I beg most respectfully to call the attention of the Honorable Court of Directors.

Unfortunately, by the time that the merits of the protective coating in question were properly established, the huts at the various camps had been already coated with tar or other materials which did not admit of removal from the wood, except at considerable expense.

The silicate of soda and lime coating has however been tried and applied to a small extent at Aldershot and at Alderney.

Fifteen tons of the silicate of soda have moreover been sent by Government to China for the purpose of coating the hutting.

The advantages of the material referred to for coating timber may be embraced under the following headings.

1stly. The simplicity of its application.

2ndly. The circumstance that it forms an excellent protective to wood against weather, and may therefore be employed as a substitute for tar or paint.

The colour of the coating itself is nearly white ; a small admixture of an ochre serves to remove the glazing nature of the coat.

3rdly. The cheapness of the material, the cost of coating ten square feet not exceeding two pence.

4thly. The great efficacy of the coating as a means of protection against fire, as demonstrated by the experiments detailed in the accompanying report.

Although personally impressed with the idea, that a knowledge of the existence of the material in question, open to general use without reserve, and emanating indeed from Government itself, must be of importance to the Honorable East India Company, I hesitated to adopt the step I am now taking, until I had consulted Colonel SANDHAM, who urged me strongly to lose no time in bringing the subject to their notice.

I beg to enclose a copy of the directions for preparing timber with the material which have been drawn up by desire of the Inspector General of Fortifications and to state that it will afford me pleasure to give any further information on the subject that it is in my power to afford should the Honorable Court of Directors feel desirous of taking it into consideration.

From F. A. ABEL, ESQ., *Chemist of the War Department, Woolwich, S. E.*, 27*th August* 1857.

I have the honor to acknowledge the receipt of your letter of the 26th instant, informing me that the Court of Directors of the Honorable East India Company have directed copies of my communication of 30th ultimo, and of printed directions to be enclosed to the several Governments in India.

With reference to the concluding paragraph of your letter referring to my statement as to the employment of silicate of soda in China, I beg to observe that from the quantity sent out (15 tons) and from the correspondence which I had at the time on the subject with the authorities at the War Office, there is no doubt that the silicate and lime is to be used in China as the coating material for the wooden erections required at the stations there, and has not been sent out as a matter of experiment.

Having heard that the great risk of fire arises from the thatching employed for the roofs of hut buildings in India,—I am anxious to state for the information of the Directors and of the Government of India, that the silicate of soda admits of very simple application to the thatching as a protective material.

The thatching would require soaking for a short time previous to use in a solution of silicate, and the thatched roof when dry should receive a thin coating of lime or clay stirred to a cream with solution of silicate.

It would probably be found advisable to renew the exterior coating of wash after the rainy season.

I beg again to express my readiness to furnish every information which may be required on the subject.

Remarks on the Protection of Wood from Fire. By F. A. ABEL, ESQ., *accompanied by a Report from Colonel Sandham, R. E., and himself.*

The attention of practical men has been for some years past directed, from time to time, to the importance of affording to wooden erections some degree of protection from the effects of fire; and

numerous plans have been proposed, and to some extent tested, for lessening the combustibility of wood, and for covering its surface with a protective coating more or less unalterable by fire.

The simple application of lime or clay-wash, for example, has been found to afford some slight protection to wood, although the tendency of such materials to peel off the surface of the wood (into which they do not in any way penetrate), by exposure to heat, and the rapidity with which the coating is destroyed by atmospheric influence, render them very ineffective agents.

Several processes have been patented, even recently, for the protection of wood from fire. Some idea of the general nature of such processes will be conveyed by the following extract from an official report made on this subject :—

"The importance of obtaining an effective method of reducing the combustibility of wood, or even of protecting its surface from fire, has led to an examination into some of the methods of accomplishing this, which have been lately patented, and of the general nature of which the following is a brief statement.

I.—"*Mr. Maugham's Patent* consists in saturating dried wood with an aqueous solution of phosphate of soda and muriate or sulphate of ammonia, in certain proportions.

"It is believed by the patentee that these salts will be so affected by each other, and by the action of heat, that the fibres of the wood will be protected by an incombustible coating, while a quantity of vapour will be generated by the volatilisation, and partial decomposition, of the ammoniacal salts, which will possess the power of extinguishing flame.

"The same objects are believed to be obtained by—

II.—"*Lieutenant Jackson's Patent Process*, by which wood is impregnated with a solution of salts of zinc and of ammonia.

"The same means are adopted in both of these processes for saturating the wood.

"It is packed into large cylinders from which the air is then exhausted, the liquid being afterwards forced in with a pressure of 150 to 200 lbs., which is maintained during one or two hours.

It is the same method as that employed in patent processes for preserving timber from decay.

"I am not aware whether Mr. MAUGHAM's process has been submitted to any extensive practical test. Numerous experiments were however instituted on Lieutenant JACKSON's process, under the direction of Mr. BRUNEL.

"Specimens of seventeen different kinds of wood were prepared; corresponding pieces being kept unprepared, and others covered with a coating of paint. Their powers of resisting fire were tested by piling the prepared, unprepared and painted specimens round a perforated sheet iron surface, filled to the top with a bright coke fire.

"In most cases the prepared wood resisted the action of fire for a longer period, and, when removed from the fire, ceased burning sooner than the unprepared specimens.

"It was also evident that light porous woods were more efficiently protected than those of a denser character.

"There is no doubt therefore that the combustibility of wood is more or less diminished by either of the above methods of treatment, although the protective action must be ascribed to the indestructible compounds with which the wood is to some extent impregnated, far more than to the vapours evolved by the decomposition of the small quantities of ammoniacal salts forced into the wood.

"Although by the impregnating process adopted in the above patents, the preparative solution is believed to be forced into the very centre of the wood, it is essential, if such a result is to be obtained, that the solution should be weak, since it is impossible to force strong saline solutions thoroughly into wood.

"It is evident that the protective action of the salt cannot, under these circumstances, be very powerful.

"Were it possible, on the other hand, to employ stronger solutions, the expense of the processes would be considerable.

"The necessity of costly apparatus for impregnating the wood is also a matter of serious moment."

The patentees of some of the wood-preserving processes go so far as to state that they are enabled to render wood incombustible or uninflammable, and such statements have tended to lead to the presumption that a thoroughly effective protecting agent should have the power of depriving wood of its combustibility.

It will be readily understood, however, that even if a piece of wood could be most thoroughly impregnated with a solution of some strength, of matter unalterable, or at any rate only fusible, by continued exposure to heat, the amount of protective material thus deposited in the pores of the wood, although it might be considered to surround each particle of fibre, would not prevent the destructive distillation of the wood by the effect of heat, the result of which would be the disengagement of inflammable vapours from the wood, and its ultimate complete ignition, if maintained for a sufficient period in the vicinity of highly heated or burning matter; or, if on the other hand, the protective agent employed be convertible by heat into vapours possessing the property of extinguishing such fire as they may completely surround, such vapours might have the effect of partially or completely extinguishing the fire in a piece of ignited wood, *after* its removal from the source of heat or fire, but otherwise the volume of vapour generated from the preparation used, would be but slight, as compared with the inflammable vapours evolved from the over-heated wood, and would have no perceptible effect on the combustion of these, while the scorched, or charred, woody fibre would be less efficiently shielded from the effect of flame than by the coating formed from an indestructible preparation.

It does not therefore appear reasonable to expect more from the most efficient protective coating or impregnating material than—

1st. That it should considerably retard the ignition of wood, exposed for some length of time to the effect of a high temperature, or of burning matter in its immediate vicinity.

2nd. That if the vapours which the wood will emit, by continued exposure to heat, become ignited, the flames thus produced shall not readily affect the fibre of the wood, and shall cease almost directly on the removal of the wood from the source of heat; and

3rd. That prepared surfaces of wood, when in actual contact with burning unprepared wood, shall have little tendency to ignite, and thereby cause the fire to spread.

In addition to such processes as those above referred to, in which the protecting material is forced into the wood by the application of considerable pressure, trials have been made with agents of different kinds, in solutions or baths, in which the wood was steeped, or allowed to soak, for some hours, so that it might be in a slight degree impregnated with the material, or that a superficial coating of the protective might, at least, be formed.

Some of these methods have been made the subject of experiments by order of Lord PANMURE, with a view to test their merits.

One, proposed by W. C. SALOMONS, of Paris, consisted in immersing the dried wood alternately, in two baths; the one containing three parts of acid sulphate of alumina, and one part of glue, dissolved in six parts of water; the other consisting of two parts of dry chloride of calcium, one part of glue, and seven parts of water.

The objects which the inventor wishes to attain, by the use of these solutions, are, firstly, to impregnate the wood slightly with one of the salts (the chloride of calcium, for example), and then, by immersion of the wood in the second bath, to effect the decomposition of the first salt by the second, in the pores of the wood.

Thus the chloride of calcium and sulphate of alumina should become converted into sulphate of lime, and chloride of aluminum; the former an almost insoluble substance, the latter a soluble deliquescent body, possessing the property of converting the glue, employed, together with the salts, into an insoluble body—a species of leather.

The pores of the wooden surfaces are therefore, by the treatment in question, to be filled up by particles of a substance nearly insoluble, and unalterable by heat, which, together with the soluble salt, also present, are to be protected and united by means of the precipitated glue, which dries up to a hard, horny substance.

The experiments made with this process showed that the glue employed in the solutions greatly impeded the penetration of the wood by the saline matter, and also caused the decomposition of the salts to be very partial.

The protective property of the coating formed on the wood, prepared by this process, was not found to be considerable, while the expense of the materials was great, as compared with others equally efficient.

The successful results obtained on the Continent by the application of alkaline silicates, as protective materials, led to an examination into the comparative value of the cheapest of these, the soluble silicate of soda, as an agent for decreasing the combustibility of wood.

The property possessed by the soluble alkaline silicates, of being readily softened by hot water, and thus converted into a state of solution, while they are but slightly affected by cold water, renders their application to wood, either in the form of a bath, or as a wash, very simple. Their dilute solutions being readily absorbed by wood the surfaces of the latter, as it dries, assume the form of a hard coating.

The experiments made in the first instance with the silicate of soda, and the results obtained, are described in the following extract from the official report :—

" Various specimens of dry wood were prepared with silicate of soda, by being soaked for a few hours in a weak solution.

" Upon examining the interior of these, after the removal from the bath and subsequent desiccation, the silicate was found to have penetrated about a quarter of an inch on all sides.

" On piling the above over a fire, together with specimens of unprepared wood, and others that had been prepared by different processes, the superiority of the silicate of soda, as a protective agent, was fully established.

" Some specimens of wood were then simply painted with a moderately strong solution of silicate, and afterwards placed, together with unprepared wood, in a pool of coal-tar naptha some of the latter being thrown over the surfaces of the wood.

Uupon the results of these experiments being reported, an order was issued by Lord Panmure to have the proposed process for

the protection of wood from fire, practically tested at some of the camps or stations.

It was ultimately arranged that a proper trial of the process should be instituted at Chatham, under the direction of Colonel SANDHAM, R. E.

The nature of the experiments performed at Chatham, and the results obtained, are detailed in the following official report :—

Report on Experiments at Chatham, from Colonel SANDHAM, *R. E., and* F. A. ABEL, ESQ., 1*st March* 1856 ; *to the Inspector General of Fortifications.*

Sir,

We have the honor to inform you that some experiments with silicate of soda applied in conjunction with lime-wash, as a means of protecting wood from fire, and of retarding its combustibility, have been made at Chatham, on a sufficient scale to determine practically the value of this agent, if applied as a preservative to camp-huts.

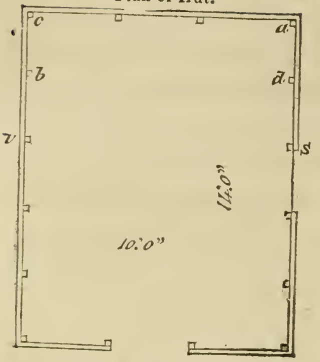
The following is an account of these experiments, and of the results obtained.

A small single-boarded hut was built in the model Battery, the material used in its construction being of the description usually employed for camp huts.

It was provided with one door, and a window-opening on one side, closed by a shutter.*

After the hut was completed, certain portions of it were prepared, on the 8th and 9th of January, with the silicate of soda in the following manner :

* The hut was 14 feet by 10 feet, 6 feet high at eaves, and 9 feet at ridge ; it was constructed of ¾ inch deal weather boarding, on quarters and rafters of deal, 3 inch by 2 inch Door, 6 feet 6 inches by 2 feet 9 inches, of 1 inch deal, and window 3 feet by 2 feet, closed by a shutter of 1 inch deal. Floor of 1 inch deal, on fir joists, 4 inches by 2 inches, the upper surface of floor being 6 inches above the ground. Both sides of the walls from *o* to *s*, and from *v* to *n*, were prepared. The insides of the portions *a b*, *c d* were painted with common oil paint in three coats, that at *a b* being laid on the prepared part, while that at *c d* was laid on the unprepared part.



1st. The wood was washed over with a somewhat dilute solution of the silicate of soda, applied in the manner usually adopted for whitewashing walls.

2nd. After an interval of about two hours, a coating of thick lime-wash was applied, over that of the silicate.

3rd. On the following day the prepared portions of the interior of the hut received, upon the lime, a second application of the solution of silicate of soda, a little stronger than that first applied.

Shortly afterwards the exterior prepared portion of the hut was similarly coated with the silicate.

The prepared wood therefore received.—

1st. A coating of dilute silicate of soda, which penetrated slightly into the wood, generally to the depth of about $\frac{1}{10}$ inch.

2nd. A coating of thin lime wash, and

3rd. A second coating of silicate of soda, which, acting chemically upon the lime, formed a hard protective coating with the latter on the wood.

Two opposite corners of the hut, with about one-third of each side, and a corresponding portion of the roof, were left unprotected.

One side of one of the unprotected corners of the hut received three coats of paint; a similar coating was applied, over the protective coating, to one side of a prepared corner. Some pieces of plank were also prepared with the silicate of soda, and lime, as described above.

Experiments with the prepared hut were unavoidably deferred until the 12th of February, 1856. During the interval the hut had been repeatedly exposed to very heavy rains; but although the light wood of which it was constructed was eventually completely saturat-

ed with wet, the coating on the wood was not in the slightest degree injured, and could be removed, by knocking the wood, only in one or two places in the roof, where the surface of the boards was very rough, and the coating consequently less perfect.

EXPERIMENT 1.

A fire of wood, charcoal, and coke was kindled in a tall iron stove provided with numerous large openings in the sides, so as to adimit of a great escape of heat in the neighbourhood of the boards.

" Immediately on the ignition of the naphtha, the wood was surrounded by flames, which soon fired the unprepared pieces, whilst those coated with the silicate only ignited after a time *at the edge*, and were scorched or baked by the heat, but not burned.

" A wooden hut, similar in construction to those at Aldershot, having been erected in Woolwich Marshes, for the purpose of testing the value of Phillips's Fire Annihilator, advantage was taken of the opportunity thus offered for trying,to some extent, upon a larger scale, the merits of the silicate as a protective.

" Shortly before the experiment took place, an application was made to me, by the officers of Royal Engineers, for the preparation, in some way, of a portion of the building with a protective agent.

" One part was painted, inside and out, with a mixture of lime and alum, which, however, was not found upon experiment to act as an efficient protective against fire.

" Another part of the hut was painted, inside and out, three times, with a solution of silicate of soda.

" Unfortunately for the fairness of the experiment, the building was constructed with a double boarding, so that it was only possible to coat or impregnate the planks, on one side. Nevertheless, the value of this agent was established beyond doubt.

" A large heap of shavings was lighted in the interior of the hut, against the coated portion of the wall. The flames played fiercely upon the latter for some minutes, but only succeeded in kindling one edge of a plank, and that portion did not blaze, but smouldered for a short time.

"By the heat of the fire, the salt was drawn to the surface of the wood, and fused, forming a glazing upon it.

"Subsequently, when the whole building was destroyed by fire, after unsuccessful attempts to extinguish it by means of the "Annihilators," the fierceness of the flames was such, that few materials could have withstood it: yet, of the exterior coated portion of timber, several planks remained.

"Upon examining these, the unprotected surfaces which had been directly exposed to the fire were found to be completely charred, but this charring had extended only to the point to which the silicate had penetrated from the other side of the plank.

"This experiment is considered to have proved that the silicate of soda is a very valuable protective agent, and that, even when simply applied as a paint, it will serve to protect wood for a considerable time from fire, and to retard greatly the spreading of a conflagration."

Shortly after the experiments above described were made, the possibility suggested itself of rendering the coating of silicate less destructible by exposure to wet, of increasing its efficiency as a protective, and of rendering its application more economical, by combining with its use that of ordinary lime-wash.

Some pieces of plank were prepared in the following manner; a dilute solution of the silicate of soda was first applied with a brush; when this had thoroughly soaked into the wood, and dried, a thick lime-wash (made by slaking some lime, and reducing the hydrate to a smooth wash of the consistence of thick cream) was applied, and lastly, after the planks had been exposed to the air for two or three hours, they were painted with a second solution of silicate of soda, somewhat stronger than that first used. The effects of the liquids thus applied, both upon the wood and on each other, will be more particularly pointed out in a report subjoined.

Several experiments, precisely similar to those described below, were made with the prepared planks, the results proving most satisfactorily that the protective coating resisted to a remarkable degree the action of heat, evinced no symptom of peeling off the highly heated surface of the wood, and protected the fibre to a great degree from the influence of flame playing upon its surface.

The durability of the coating was tested by exposing prepared surfaces of wood to a continuous stream of water, and to heavy rains, for a considerable period. It was found that the rain had no effect upon the coating; in the other more severe test, the material was only to some extent removed, after a time, on that spot where the jet of water first impinged upon the wood.

A trial was made of the firmness of the coating, by applying heavy blows to the surface of the wood; the covering was only disturbed in one or two places, where the lime had been laid on rather too thickly.

The stove was placed in a prepared corner of the hut, at a distance of about 10 inches from the sides, and the fire was speedily raised to a sufficient degree to render the sides of the stove red hot in several places.

About one hour and a quarter elapsed, after the stove was well alight, before those portions of the sides nearest to the hottest parts of the fire evinced any sympton of igniting, although the wood was scorched, and to a great extent baked, in several places: those portions becoming at last so hot on the outside, that the hand could scarcely be placed against them.

At this point, the prepared side which had been painted, became ignited, the vapours emitted from it, by the baking of the wood, being very considerable. The remainder of the heated corner inflamed instantaneously, but the flame was not so powerful as that covering the painted portion.

After the first burst of flame from the prepared planks, produced by the ignition of the vapours baked out of the wood, the fire went down considerably and made but very little progress. Now and then a small burst of flame was seen on the outside, issuing from between the joints of the weather-boarding, but it was soon evident that the fire could only with great difficulty seize permanently on the prepared surface of the wood, and that it only spread very slowly by creeping along between the overlapping portions of the planking, which were unprotected, and between the quarter-

ings and the planks, where the surfaces of the wood could not be reached by the brush in the process of preparation.

Some pieces of plank, which had been piled against the stove in the building, having become inflamed, as also a small portion of the flooring, which was not prepared, a pail of water was thrown, from the doorway, at the stove, whereby the fire from the planks was extinguished ; the water, however, scarcely reached the sides of the hut and did not affect the fire in the stove.

About an hour after the corner of the hut had been kindled, the stove, which had some time before partly fallen from some of its supports, so that it actually leaned against one side of the hut, protruded from the opening ultimately formed in the corner by the fire, which, though not interfered with, had confined itself almost to the immediate vicinity of the highly heated stove.

The latter was now removed from the hut through this opening, and a short time after, a little water was used to extinguish the fire which had been communicated to that part of floor over which the stove had been standing.

The fire which was burning here and there very slowly, in the corner of the hut, was left untouched.

Experiment 2.

Soon after the experiment above described had been commenced, and before the fire in the stove had produced any effect upon the hut, a pile of shavings and wood, with a little tar, was made in the opposite prepared corner of the hut, upon some loose prepared planks (laid down to save the unprepared flooring of the hut,) and, this having been kindled, a fierce fire was maintained for about ten minutes ; the flames licking the sides of the hut and a portion of the roofing.

At the expiration of that time, the sides and upper corner of the hut were perceived to be burning in a few places, at the edges of the weather-boarding. A short time afterwards the pile of fire was withdrawn, upon which the prepared surfaces of the wood immediately ceased burning, and it was found that the fire had

only to a slight extent seized permanent hold of the corner, in three places.

1st. At the bottom where two planks overlapped : the fire was soon extinguished spontaneously at this point.

2nd. About half-way up the corner between the back of the quartering and the weather-boarding, where the fire continued to smoulder on, consuming the unprepared portion of the wood in that spot.

3rd. In the upper corner, immediately under the roofing. At this spot, there was necessarily a considerable portion of wood (the backs of the joists, wall plates, and planking) which could not be reached by the preparation, and which therefore served as a hold for the fire.

It was interesting to observe how in this, as in the experiment first detailed, the fire slowly crept along those small portions of wood which had escaped preparation, in the protected corners (*i. e.*, the overlapping edges of the weather-boarding, and the backs of the quarterings) ; while the prepared surfaces of wood exhibited no tendency to carry the fire along, and were only consumed when in contact with other burning matter, or when surrounded for a length of time by flame from unprotected portions of the wood.

Although, at the expiration of about three hours, portions of the two opposite corners of the hut were still burning ; and frequent gusts of wind served to fan the fire, it was found that the hut could be left, without fear of the fire spreading so as to become unmanageable.

Upon our returning to the hut, after the lapse of about half an hour, the fire was still found smouldering here and there in both corners, having extended very little farther along the unprotected portions of the wood, as above described, particularly between three of the joists, and in the corner immediately under the roofing.

The effects of the fire were watched for a short time longer, and the few burning places in the prepared corners were then extinguished by the application of a little water from a mop.

The above experiments showed that although the attempts to kindle the protected corners of the hut had ultimately succeeded, in one instance, by the maintenance of a fierce fire for several minutes against the wood, and in the other by the immediate vicinity, and even actual contact, of a highly heated stove with the wood, for a great length of time.—

1st. The prepared surfaces of wood, having been thoroughly baked, only burned as long as they were in close contact with burning, or highly heated matter, or for an instant when exposed to a powerful current of air; and did not possess any tendency to lead the fire along, this being only effected by the unprepared portion of the wood:

2nd. At any period during the four hours, for which time the fire was allowed to exert its uncontrolled effect upon the prepared portions of the hut, the burning parts of the building could have been with ease extinguished, by means of a couple of pails of water.

Experiment 3.

While the experiments with the hut were being carried on, some pieces of prepared and of unprepared planking were piled together in two similar heaps in the open air, and a fire of shavings and wood-chips was made up under them.

The comparative tardiness with which the prepared planks inflamed, and the difference in time required to effect the actual ignition of these and that of the unprepared planks was very evident, as was also the case with pieces of planks which had been piled up against the sides of the stoves in the building.

The prepared boards upon which the fire had been kept up in the corner of the hut were also examined, and found to be but little affected by their protracted contact with burning matter.

The wood had only caught at the edges, and was found smouldering there in two or three places.

By submitting the glimmering portion to the blast of a bellows, a small flame was produced, which went out immediately on the removal of the current of air.

EXPERIMENT 4.

In order to have convincing proof of the advantages of the preparation in retarding the ignition of wood, it was resolved to make experiments, similar to those described as Nos. 1 and 2 ; to observe the difference in time required for the ignition of the wood in the unprepared corners of the hut, and to ascertain the comparative power of the fire to extend, in these parts.

A fire was kindled in the stove placed in one of the unprotected corners of the hut. In about ten minutes after the stove had become thoroughly heated, the sides of the hut burst into flames, which at once rose to the roofing above, and kindled portions of it.

A heap of wood and shavings was lighted in the opposite unprepared corner, and in two or three minutes this portion of the hut was in flames.

The unprepared wood having been once kindled, the fire spread so rapidly as to be quite unmanageable in a few minutes, the flames completely filling the interior of the hut. But even under these circumstances, when the intense heat and fierce flames from the burning portions soon spread the fire to the prepared parts of the hut, it was remarkable how the flame crept along between the crevices and overlapping portions of the planks where the wood was unprepared, so that the prepared surfaces were always thoroughly surrounded by flame for a considerable time before they ignited. Some portions of the prepared planking, of which the wood had probably imbibed a rather larger quantity of silicate, in consequence of its greater porosity, offered great resistance to the fire to the very last.

We consider the experiments above detailed to have afforded conclusive proof on a practical scale, of the considerable power possessed by silicate of soda, applied simply as a coating, in conjunction with lime, of retarding the inflammability of wood.

It is, of course, impossible even by the thorough impregnation of wood with various substances, to deprive it of the property of burning ; the only results to be attained by the use of a protective material are,—

1st. To shield the substances of the wood itself in a great degree from the effects of neighbouring fire, or of the vapours which will issue from over-heated wood, and burn on its surface, and.—

2nd. To deprive the wood to a considerable extent, of the power of carrying the fire along, thus rendering necessary the *continued application* of heat or fire from another source (such as an over-heated stove or unprotected portions of wood) in order to effect its thorough ignition.

An examination of the experiments just described will show that these results are obtained by the application of the silicate of soda to the wood. This substance may be obtained in any quantity at a very reasonable rate and the method of applying it is so simple, that the wood may be properly prepared with it by ordinary workmen.

It appears to us important that, if its application to new Camp huts should be determined upon, the wood to be employed in their structure should be completely coated with the preparation, before the erection of the buildings, in order to give the latter a fair chance of resisting the action of fire, reaching the wood from any quarter.

But even in buildings already erected, it is of importance that those portions which are in any way liable to possible exposure to heat or fire (*e. g.* the portions in the vicinity of stoves), should receive the very considerable protection which would be afforded by the application of the silicate coating, any covering of paint or paper having first been remcved.

We beg to give it as our opinion that the efficiency of the protective agent in question has been sufficiently tested to obviate the necessity of further trials upon a large scale, and submit, in conclusion, that while the extensive employment of light wooden buildings for huts and temporary workshops, renders the application of some protective material to the *interior* of these, at any rate, a matter of great importance, it is of equal consequence that such an agent, if adopted for use in the service, should be easy of application and inexpensive, and that its employment should be as completely under the control of Government as that of any ordinary coating material.

The above report was accompanied by a communication relating to the cost of the application of the silicate coating, in which it was stated that, provided the silicate of soda employed has been prepared with especial reference to this application (*i. e.* so as to be readily and completely misceable with water,) one pound of the material is sufficient to prepare a surface of wood of ten square feet; while the wholesale price of the silicate, in the form of a syrup of a certain degree of concentration, is twenty pounds per ton; so that the cost of the silicate, required to prepare the wood, is at the rate of about two-pence for a surface of ten square feet.

Experiments are just now being carried on, with a view to impart to the silicate coating the appearance of paint, by combining the use of different colouring matters with that of the lime.

The following are the directions adopted for general guidance, in preparing wood with the coating of silicate of soda and lime.

DIRECTIONS FOR COVERING TIMBER WITH A PROTECTIVE COATING OF THE SILICATE OF SODA AND LIME.

Materials employed.—The silicate of soda, must be in the form of a thick syrup, of a known degree of concentration, as manufactured by Messrs. SIMPSON and Co., Kennington Road, London.

The lime-wash should be made by slaking some good fat lime, rubbing it down with water until perfectly smooth, and then diluting it to the consistency of thick cream.

Treatment of the Wood.—The protective coating is produced by painting the wood, firstly with a dilute solution of silicate of soda; secondly, with the lime wash; and lastly, with a somewhat stronger solution of the silicate.

The surface of the wood should be moderately smooth, and any covering of paper, paint, or other material should be first removed entirely, by planing or scraping.

A solution of the silicate, in the proportion of one part by measure of the syrup to three parts of water, is prepared in a tub, pail, or earthen vessel by simply stirring the measured proportion of the silicate with the water, until complete mixture is effected.

The wood is then washed over with this liquid, by means of an ordinary white-wash brush, the latter being passed two or three times over the surface, so that the wood may absorb as much of the solution as possible. When this first coating is nearly dry, the wood is painted with the lime-wash in the usual manner.

A solution of the silicate, in the proportion of two parts by measure of the syrup to three parts of water, is then made; and a sufficient time having been allowed to elapse for the wood to become moderately dry, this liquid is applied, upon the lime, in the manner directed for the first coating. The preparation of the wood is then complete. If the lime-coating has been applied rather too thickly, the surface of the wood may be found, when quite dry, after the third coating, to give off a little lime when rubbed with the hand. In that case, it should be once more coated over with a solution of the silicate, of the strength prescribed for the second liquid.

Directions for Covering Timber with a Coating of the Silicate of Soda and Lime, as a Protective from Fire.

MATERIALS EMPLOYED.

THE SILICATE OF SODA must be in the form of a thick syrup of a known degree of concentration, and is diluted with water when required for use according to the prescriptions given below.

The lime-wash should be made by slaking some good fat lime, rubbing it down with water until perfectly smooth, and diluting it to the consistency of thick cream.

TREATMENT OF THE WOOD.

The protective coating is prduced by painting the wood, firstly with a dilute solution of Silicate of Soda; secondly with the lime-wash; and lastly, with a somewhat stronger solution of the Silicate.

The Surface cf the wood should be moderately smooth, and any covering of paper, paint or other material, should be first removed entirely, by planing or scraping.

A solution of the Silicate, in the proportion of one part by measure of the syrup to four parts of water, is prepared in a tub, pail or earthen vessel by stirring the measured proportion of the Silicate

first with a very small quantity of the necessary water until a complete mixture is produced, and then adding the remainder of the water in successive quantities, until a perfect mixture in the requisite proportions is obtained.

The wood is then washed over with this liquid, by means of an ordinary white-wash brush, the latter being passed two or three times over the surface, so that the wood may absorb as much of the Solution as possible. When this first coating is nearly dry, the wood is painted with the lime-wash in the usual manner.

A solution of the Silicate, in the proportion of one part by measure of the syrup to two parts of water, is then made as above described; and a sufficient time having been allowed to elapse for the wood to become moderately dry, this liquid is applied, upon the lime, in the manner directed for the first coating. The preparation of wood is then complete. If the lime coating has been applied rather too thickly, the surface of the wood may be found, when quite dry after the third coating, to give off a little lime when rubbed with the hand. In that case, it should be once more coated over with a solution of the Silicate of the first-named strength.

(Signed) F. A. ABEL,

ROYAL ARSENAL WOOLWICH. *Chemist of the War Department.*

NOTE.—[The Marquess Origo, Commandant of the firemen at Rome, dipped the dresses of his men in a solution of *Sulphate of Alumine* and *Sulphate of lime.* Clothed in these suits, and their faces covered with incombustible masks, they traversed burning buildings without injury. *Journal of the Royal Institution of Great Britain*, 1831, p. 164.]—ED. M. J.

SCIENTIFIC INTELLIGENCE.

Scientific Mission to India.

An important paper has just been read to the Academy of Sciences on a mission sent to India and Upper Asia in 1854, by the King of Prussia and the East India Company. The members of the mission consisted of three brothers, MM. Herrmann, Adolphus, and

Robert Schlagentweit, two of whom, MM. Herrmann and Robert, returned in June last; the third, M. Adolphus, is still among the Himalaya mountains, and is expected soon to return, *viâ* the Punjaub and Bombay. During the winter of 1854-55, these enterprising travellers visited the region lying between Bombay and Madras; in the following summer M., Herrmann explored the eastern parts of the Himalaya, the Sikkim, Bhootan, and Khasia mountains, where he measured the altitudes of several peaks. The highest of all the summits known throughout the world appears, by his measurements, to be the Gahoorishanka, situated in the eastern portion of Nepaul—the same announced as such by Colonel Waugh, but called by him Mount Everest, because he had been unable to ascertain its real name in the plains of Hindoostan, where he effected his measurement. This peak is somewhat more than 29,000 feet in height, and bears another name in Thibet, where it is called Chingopamari. The other two brothers penetrated by different roads into the central parts of the Himalaya, Kumaon, and Gurwhal; they then visited Thibet in disguise, entered the great commercial station of Gartok, explored the environs of Lake Mansarowr, and that remarkable crest which separates the waters of the Indus from those of the Dihong, often erroneously called the Burrampooter. They ascended the Ibi-Gamine, 22,260 feet in height, that being an altitude never before attained in any part of the world. After having been separated from each other for a space of fourteen months, during which M. Robert ascertained that the table-land of Amarkantak, in Central India, which is generally stated to be 8,000 feet above the level of the sea, is not more than 3,300 feet in height, the three brothers again met at Simla, previous to commencing the operations intended for the summer of 1856. M. Adolphus, on leaving that place, crossed the Himalaya, went over Thibet, Baltistan, and visited the interesting spot where several mountain crests meet, and the Hindoo Koosh joins the range lying to the north of India. He then returned to the Punjaub through the valley of Cashmere. MM. Herrmann and Robert proceeded to Ladak by different routes. Under good disguises, they were enabled to penetrate into Turkistan, proper by crossing the Karakoram and the Kuenlun mountains, and descending into the great

valley of Yarkand, a region never visited before, not even by Marco Polo. It is a vast depression of between 3,000 and 4,000 feet, separating the Kuenlun, on the northern frontier of India, from the Syan-Chane, or mountains of Central Asia, on the southern border of Russia. They then returned to Ladak, and entered into the Punjaub by different routes through Cashmere. After a two years' negotiation, M. Herrmann was, at the commencement of 1857, admitted into Nepaul, where he determined the altitudes of the Machipoora and Mount Yassa, which have hitherto been vaguely called the Dhawalaghiri, which means nothing else but "snowy crests," and is applicable to all snow-capped mountains. M. Robert proceeded to Bombay through Scinde, Kutch, and Guzerat, where he surveyed the chain called the Salt Range, and determined the changes effected in the course of centuries in the course of several rivers. Before returning to Europe, he stayed three months in Ceylon. M. Adolphus visited various parts of the Punjaub and Cabul, previous to returning to the Himalaya, where he still is. The chief results obtained from this careful exploration of Asia are the following:—The Himalaya mountains everywhere exercise a decided influence over all the elements of the magnetic force; the declination everywhere presents a slight deviation, causing the needle to converge towards the central parts of that enormous mass, and the magnetic intensity is greater than it would be anywhere else under an equal latitude. In the south of India, the increase of the magnetic intensity from south to north is extremely rapid. The lines of equal magnetic intensity have a remarkable form, similar and perhaps parallel to those of certain groups of isothermal lines. The three travellers have collected all the materials necessary to ascertain this important fact. Irregular local variations in terrestrial magnetism are rare in those regions. In the Deccan and Behar the rocks are magnetic. On the Himalaya, at altitudes of 17,000 and even 20,000 feet, the daily *maximum* and *minimum* variations of the barometer occurred nearly about the same hours as in the plains below. Again, at the above altitudes, the inversion of the curves of daily variation, which is met with on the Alps, does not take place. At the altitude of 17,000 feet, the diminution of transparency produced by a stratum of air of the thickness of 3,000 feet is no longer distinguishable by the eye. During the

dust storms which frequently occur in India, the disc of the sun is seen of a blue colour; if small bodies are made to project their shadows on a white surface under such circumstances, the shadow is of an orange colour—that is, complementary to blue. The transparency of the waters of the Ganges, the Burrampooter, and the Indus was tested by letting down a stone into them, which generally became invisible at a depth of from 12 to 15 centimetres (5 to 6 inches), showing that they are overcharged with earthy particles, for in the sea near Corfu a stone is visible to the depth of 50 feet, and in these as under the tropics it remains visible at a depth of 30 feet. —*Times, 23rd October,* 1857.

Poisoning with the Seeds of Thevetia neriifolia.

The following extract from a communication by Dr. DOUGLAS MACLAGAN to the Botanical Society of Edinburgh, is worthy of attention, detailing the history of two cases of poisoning by a shrub, common in our gardens, known as the exile or yellow Oleander. Dr. J. BALFOUR, Bengal Army, was called by the Native doctor to see his own children, reported to be suffering from obstinate vomiting, and narrates as follows:

" Upon investigation, it turned out that, they had found the seeds of a shrub called by the natives Cheen-ke-kunēr or the Chinese Oleander, said to be the Jatropha multifida, or one of the physic nuts; they had broken the nuts, and finding the kernels bitter, had played at 'Doctors,' and had each eaten about one whole nut. (A younger boy, said to have eaten half a nut, did not suffer at all.) This was about noon, at three they eat their dinner, in their ordinary style, and were free of complaint; they appeared quite well when I left them, about a quarter past six, to go out to dinner, but soon after began to feel unwell, for they refused their tea. The principal peculiarity in the action of the poison was the style of vomiting; no retching nor straining, but a single gulp, without much apparent distress, and then an immediate return to the recumbent posture, and a state of somnolence. The pulse in No. 1 was very weak as well as slow, and I was anxious about him for some time. The taste of the kernels is extremely bitter—a persistent aloe flavour—and in this also I think it differs from the

description given of the physic-nut, which is stated to be sweet like almonds.—JOHN BALFOUR.

A single glance at the specimens, which the letter enclosed, sufficed to show (that they had nothing to do with Jatropha multifida, but) that they belonged to one of the Apocynaceæ, and a short search through the University Herbarium enabled me to identify the plant as *Thevetia neriifolia*, Juss. *Ann. Mus.* 346.

This is a species well known throughout India, more commonly under its older synonyme of *Cerbera Thevetia*, Linn. It occurs in almost all the collections from India, which are in the University Herbarium. In Hamilton Buchanan's Catalogue, where it forms No. 718, under Willdenow's name of Cerbera Thevetia, there is the following account of it:—

'Hab. in hortis Magadhae. Simillima certe plantæ quæ, ex America, alata, in horto botanico prope Calcuttam colitur, et perhibent Brahmani plantam in scriptis suis antiquis bene esse cognitam.'

On the tally, however, accompanying the specimen to which this refers, there is written—

'This really was introduced by Dr. Roxburgh, but is called the yellow oleander, and supposed to have come from Nepal. Patna, 22d April 1812.'

The affirmation made in the catalogue, that it resembles a species brought from America, appears to be true; for, on comparing it with a Cerbera from Peru, in the University Herbarium, sent as *Cerbera peruviana* (Mathews' Catalogue, 442), I can see no trace of difference between the two plants, and this is the opinion maintained in De Candolle's Prodromus, where, under Thevetia neriifolia, are given not only Cerbera Thevetia, but C. peruviana, as synonymes.

O'Shaugnessy states that *Cerbera Thevetia* is 'said to be powerfully febrifuge, two grains being affirmed to be equal to a common dose of Cinchona.' [Beng. Dispensatory, p. 447.]

Dr. B. subsequently wrote "that young M—, one of the poisoned, who had been subject to ague up to the time of eating the seeds, has had none since. True, the aguish tendency was much weakened, but perhaps the poisoning did him good."

Almost every Indian plant possessed of bitterness, is said, if not in India, at least in books, to be reputed febrifuge; and as to its effects on young M——, it need hardly be remarked, that a periodic disease, especially if on the wane, might be readily broken up by any agent producing such a commotion in the constitution as in this case.

There can be little doubt that, whether febrifuge or not, the Thevetia is possessed of very active properties. The symptoms, at first sight, seem to be those of a narcotico-irritant, the irritant action predominating ; but, from Dr. Balfour's description, I am inclined to doubt their being narcotic in the true sense, the somnolence, etc.. being more like that of exhaustion from a violent acrid ; the peculiar vomiting was perhaps an action of the stomach itself, unaided by the abdominal muscles and diaphragm. We might well expect the plant to be possessed of dangerous qualities of some sort, considering its affinity with the very acrid Cerbera Manghas of the East Indies, and the still more deadly C. Tanghin, the ordeal poison of Madagascar, of which, if we are to believe it, 'a kernel not larger than an almond is sufficient to destroy twenty people.' "

[This notice, contains an important addition to our knowledge of an indigenous Medical plant, the bark of which is a reputed febrifuge, but the seeds are thus proved to be a Narcotico-acrid poison.]—ED. M. J.

Coal in Scinde.—It gives us much pleasure to learn that the coal diggings near Kotree is daily progressing favorably ; up to the 6th instant, Mr. Inman, with his staff, had completed exactly 100 feet in the Great Experimental Shaft, and passed through a three feet seam of beautiful coal, full of bitumen and gaseous principle ; the coal is so good, that it works with great advantage in the smithy, and has the peculiar property of rendering the hard harsh brittle English iron, soft and malleable as silver. Colonel Scott and Captain DeLisle both visited the place, and were highly pleased at the coal prospects of Sind. The sinking is now carried on through a hard ferruginous white sandstone not perfectly formed. Strange to say, not one drop of water had touched the shaft at this depth. —*Sindian, Jan.* 13, 1858.

Death of Mr. Purdie. On October 10, at Trinidad, William Purdie Esq., for many years Government Botanist of this Colony. The deceased was widely known for his exertions in his peculiar province, in making which he had visited nearly every portion of the Island, and carried out long investigations with no small degree of endurance.

Governor Keate has selected Dr. Kruger, a gentleman long resident on the Island, of considerable scientific attainments and well acquainted with Tropical Botany.

OBITUARY NOTICES.

Since the last issue of this Journal, we have had occasion to lament the death, of the Venerable Doctor BERNHARD SCHMID, formerly of the Church Mission, who died at Calicut, on 1st October 1857, at the advanced age of 70. This erudite Missionary came out to India in 1817, and whilst labouring in his high calling corresponded with several Savans in Germany, as Baron von HUGEL and Nees von ESENBECK; with Sir WM. HOOKER, of Kew, and with Dr. WIGHT, of Madras.

In the fourth volume of this Journal is a notice of Zenker's "*Plantæ Indicae," quas in montibus Nilagiricis collegit Bernhard Schmid.* Folio Jena. 1835.

Two decades only of this work appeared, in consequence of the early death of Dr. ZENKER, Professor of Botany at Jena, who had undertaken the publication of the extensive and valuable materials transmitted to him by our lamented friend. The publication of a serial in Saxony which depended for support upon Indian subscribers, was attended with many difficulties, but the 20 coloured Illustrations were executed in a superior style, the Analysis by SCHMID, and the Botanical Descriptions by ZENKER. At page 336 of the same volume of this Journal, is a short article "The Study of Botany recommended," which is very characteristic of the simple minded Missionary.

We find from Manuscripts placed at our disposal, that about this time, to use his own words "from the burning climate of Tinnevelly, incessant labour, and the great discouragement experienced in my work, my health failed." He left his post very reluctantly first for the Neilgherry Hills, and afterwards for Germany. During his sick leave he was not idle, and the following are a few of the Literary productions printed chiefly whilst he was on the Neilgherries.

1. "English Orthoepy or Pronouncing Spelling Book" (small Dictionary) *for* Tamulians."
2. A second Edition of Translation of Baxter's Saints' Rest.
3. Translation of the two First Books of Thomas a Kempis.

4. English Tamil Grammar, compiled for the Palamcottah Seminary.
5. A Treatise showing where the different Descendants *of Noah* settled (as far as certainly known,) and taking particular notice of all nations and countries mentioned in the Scriptures.
6. A Chronology of Universal History.
7. Introduction to do. 22 pages.

The following passage in his private Journal, will illustrate the character of the man.

" My health failing entirely, I was constrained to apply for leave to go to Europe for the recovery of my health, whilst waiting on the Hills for a reply from England, two families of the Aborigines settled near my house, in order to learn Tamul from me, and one of them with the avowed intention to be by means of the Tamul, instructed in Christianity. Whilst teaching them Tamul, I compiled a Vocabulary of their language, containing above 400 words, from which it is clearly established that their speech is an ancient, rude dialect of the Tamul. Dr. Cole intended to print it, but my strength was so exhausted that I was unable, much as I wished it, to write out a fair copy before sailing."

When, in 1836, his leave to Germany having been sanctioned, and he was preparing for the voyage, he writes " God found it good to take away by death, my three sons within four months. I had now quite given up my work among the Tamulians (although not among the Todawars,) and I occupied my mind, by writing an English Treatise ' on the Relationship of Languages and Nations,' in which I embodied the results of my philological inquiries and observations during the last 28 or 30 years. This occupation was a relief to my mind in my heavy and unexpected affliction. The treatise was printed in the Madras Journal of Literature and Science, 1837, Vol. V., p. 133. After my arrival in Germany, I made a free translation of it, which was printed at the expense of the Director of Instruction, Dr. Niemeyer, the successor in office of Aug. H. Franke of Halle, in order to recommend thereby the Mission cause to the attention of the Students in German Universities, and of the German Literary Public in general." Again, he

writes in a letter to a friend. "During the year 1840, the exhaustion of my nerves and of my bodily strength was so great, that it was quite out of the question to undertake any stated official duties, even if procurable. In the Winter of 1840-41, I had an attack of influenza which retarded my recovery. In May 1841, I went therefore to Almenau, a cold water bathing place, and submitted to the most rigorous homœopathic and hydropathic regimen for 18 months, entirely abstaining not only from wine and beer (which I had scarcely touched since my return to Germany, much less spirits,) but also from the use of tea, coffee, pepper and every kind of stimulants; and my stay there restored me to that degree of healthy, and comparatively youthful appearance, which made you overlook my grey hairs."

In the end of 1845, Dr. Schmid returned from Europe, and subsequently resided at Ootacamund, and devoted his leisure hours more especially to the study of Cryptogamic plants. We received not a month before his death, the List of Neilgherry Ferns described by Professor Kunze in the "Linnea, Vol. 8, July 1851, and a Catalogue of Neilgherry Mosses, named and described by Dr. Charles Müller of Halle in Prussia, in the "Botanische Zeitung" 1853 and 1854. These lists we have thought it desirable to publish in the present No. of this Journal; they will prove useful to the explorers of these elevated regions, as the *Spicilegium Neilgherrense* of Wight terminates with the Labiatæ.

A Genus of Acanthaceae, allied to Meyenia and Hexacentris, bears the name Schmidia, and was one of the latest discoveries of Dr. Wight. Several specimens of Ferns and Mosses were also named in honor of him by his German friends.

Dr. Schmid presented to the University Museum of Jena, a piece of the fossil wood of Trivacary, near Pondicherry, which has been described and figured in a German dissertation on Fossil woods by Professors Schleiden and EE. Schmid of Jena. A copy of this work was presented by the authors to the Library of the Madras Museum in 1856, containing lithographic figures of the following fossil woods.

Psaronius Cattai.
Peuce Sibirica, Pl. II.

Peuce pauperrima, (Schleiden.)
„ dubia,
„ Zipseriana,
„ Australis, (Unger.)
„ Schmidiana, (Schleiden)

the last being the specimen referred to. The following passage occurs in the "Musée Botanique de Baron Delessert," p. 433, 'Le reverend Bernard Schmid, Ecclesiastique de Weimar, attaché aux missions evangeliques, et qui a longtemps sejourné dans l'Inde, a parcouru les Nil-Gherry, et a fait avec soin des herbiers de plantes de ces montagnes, il a visité principalement Konnor, Kota-Gherry, Outa-Kamound, etc.'

We had scarcely heard of the removal of this venerable Missionary, when we received the sorrowful tidings of the decease of another Indian Botanist and friend, intelligence, which was much more sudden and unlooked for, and particularly affected the writer of these lines.

II. CHARES DREW, Assistant Surgeon, was educated at Plymouth and afterwards at St. Bartholomew's Hospital. He subsequently settled at Wiveliscombe, Devon, as a County practitioner, when he was advised in 1854, to compete for admission into the Honorable East India Company's Medical Service, he succeeded and stood high in the List. He brought a note to us from Dr. Hooker of Kew mentioning his acquirements in Botany. A few months afterwards, he acted for a short time as professor of Botany, Medical College. Mr. Drew was as a Member of our Society, energetic and indefatigable not only as regards the study of the Indian Flora, but with respect to all subjects coming under his observation, whence he thought he could derive useful information.

He was a skilful Histologist, and has left a Book of Botanical drawings executed by himself in a superior style, showing that he had carefully studied and accurately delineated the minute structure of several little known Genera. He adopted the excellent practice of devoting a short time daily to the Analytical study of plants. Last year, Mr. Drew, in the capacity of Secretary to the Local Exhibition of Calicut, discharged his duties most efficiently. A notice of his search for the Gutta Percha Tree of Wynaad will be found at

p. 169 of the last volume of this Journal. He had just been appointed to the Forest department, where his careful habits of inquiry, and his exactness gave the promise of his being a valuable assistant. Putting private feelings aside, we could not refrain as editing this Journal, from recording the early death of this earnest and hopeful Naturalist. It is worthy of remark, that Mr. Drew first suggested the preceding notice of Dr. Schmid, which he himself was well qualified to have undertaken, but it devolves upon the Editor to chronicle both the old and young.

III. MR. WALKER. Among the losses that have recently been sustained in the scientific circle of India, few are more to be regretted than the late HENRY WALKER, who filled the chair of Physiology and Comparative Anatomy, in the Calcutta Medical College. After two years of frequent illness and repeated warnings, which unfortunately were neglected, he was induced to leave India on Sick Certificate in March last. It was too late. Shortly after his arrival in London, he became rapidly worse, and sunk under an attack of the most recent form of his ailments, disease of the kidneys, on the 22nd May, 1857 at the age of 53.

Mr. WALKER was born of humble parents at Huddersfield, where he received his early education, and choosing the profession of Medicine, he served his apprenticeship to a Surgeon of that town. He afterwards prosecuted his studies in London, Paris and Berlin, where he was for three years, the pupil of the eminent Physiologist MULLER, and imbibed that taste for comparative Anatomy, which he afterwards pursued with such vigor.

It was not till 1839, when he had attained the mature age of 36, that he received his appointment to the Bengal Medical Service. His first employment was that of Civil Surgeon at Gowahatty in Assam, where he devoted himself with ardor to the study of Natural History. Two years later, he was nominated by Lord AUCKLAND, Surgeon of the Body Guard, in which capacity he accompanied Lord ELLENBOROUGH, in the Gwalior Campaign which led to his being appointed personal Surgeon to the Governor General, a post which he continued to fill under Lord ELLENBOROUGH's successor. He attended Lord HARDINGE throughout the Sutlej Campaign, for

his services during which he was thanked in the General Orders of 14th February 1846, and received the offer of the Superintending Surgeoncy of the Gwalior Subsidiary Force, one of the most lucrative posts in the service. Influenced, however, by a desire to take part in the organization of the Medical College, which had been for some time projected, he preferred waiting for the establishment of that Institution, which took place towards the close of the following year. He was then appointed Professor of Anatomy and Physiology, and notwithstanding an ill judged reduction of the salary, which left him in very straitened circumstances, he devoted himself with the ardor of his character to the advancement of the Institution and to the improvement of his class, resisting the temptations of private practice, which his high professional attainments would have ensured, that he might apply himself more exclusively to his Collegiate labors. In 1855, he was appointed Professor of Comparative Anatomy, in addition to the Department he already held, but he refused to be made Principal of the College out of delicacy to his colleagues, whom from a too scrupulous feeling he felt unwil- to supersede.

It was shortly after this, that his health began to fail, and he was only prevented by want of means occasioned by the niggardly salary attached to his appointment, from having recourse to the advice again and again urged upon him, of recruiting his shattered health by returning home.

Every year during the College vacation, he repaired to the Coast of Arracan, for the purpose of studying the numerous remarkable animal productions in which a tropical sea so richly abounds. His notes and dissections accompanied by elaborate drawings of Molluscs, Annelides and Radiated Animals were prepared with sedulous care and scrupulous accuracy. His researches among the naked Molluscs, particularly in the families of the *Nudi, Tecti* and *Infero-branchiata*, and the *Tunicata*, were rewarded by the discovery of numerous new and interesting forms, which he investigated with singular patience and success. The collections amassed during eight years of continued labour, contain a store of materials of the greatest value in some of the least known departments of Zoology, which he fondly hoped one day to give to the public himself, but

which it is hoped, will still be suffered to see the light. It is earnestly to be desired, that the task of editing his papers may be committed to competent hands, for we are well assured that if adequately treated, they will pove a lasting and worthy monument of one who was eminent not only for the zeal and ability which distinguish the votary of science, but for those high minded, disinterested and generous qualities that do honor to the man, and which in him were carried to an almost morbid extent.

NOTICES OF BOOKS.

Thwaites's Enumeration of the Plants of Ceylon.

Under the above title, we are happy to find from the Kew Miscellany, that Mr. Thwaites is preparing a work on the plants of Ceylon, giving a correct list of all the hitherto described species, together with generic and specific characters of such as are new. The enumeration will comprise (we understand) the Phanerogamia and Ferns. We should be glad to find, that it includes the lower orders of Cryptogamia also, for there is no man better able to undertake the Flora of that Island, or to develope the resources of the Colony.

The list of species, indigenous to the Island, as contained in the Peradenia Herbarium is nearly 3,000. Dr. J. D. Hooker, assists Mr. Thwaites in determining the correct nomenclature by verifying his species in the magnificent collection at Kew. The description of the new species will be in Latin, but the notice of " uses, &c." in English. Mr. Thwaites is now on a tour through Bintenne and the Eastern parts of the Island, enlarging his knowledge of their vegetable productions, with a view to a general introduction to the Enumeration.

Missionary Travels and Researches in South Africa, by David Livingstone, LL.D., D. C. L. London. John Murray, Albemarle street, 1857, 8vo. pp. 688.

The publication of Dr. Livingstone's Discoveries, has rendered it an easier task than usual to name the most important book of the year. The demand for copies has surpassed all experience in works of a similar description. We learn from the English Press that the avidity with which both the mercantile and the religious world have seized upon its information, may be expected, in time, to produce the most gratifying result. It is understood that Dr. Livingstone will depart for Loanda again immediately.

Of the *Tsetse*, a venomous fly, we have the following extraordinary history. This insect, the *Glossina morsitans*, "is not much larger than the common house-fly, and is nearly of the same brown colour as the common honey-bee; the after part of the body has three or four yellow bars across it; the wings project beyond this part considerably, and it is remarkably alert, avoiding most dexterously all attempts to capture it with the hand, at common temperatures; in the cool of the mornings and evenings it is less agile. Its peculiar buzz when once heard can never be forgotten by the traveller whose means of locomotion are domestic animals; for it is well known that the bite of this poisonous insect is certain death to the ox, horse, and dog. In this journey, though we were not aware of any great number having at any time lighted on our cattle, we lost 43 fine oxen by its bite. We watched the animals carefully and believe that not a score of flies were ever upon them. A most remarkable feature in the bite of the tsetse, is its perfect harmlessness in man and wild animals, and even calves so long as they continue to suck the cows. We never experienced the slightest injury from them ourselves, personally, although we lived two months in their *habitat*, which was in this case as sharply defined as in many others, for the south bank of the Chobe was infested by them, and the northern bank, where our cattle were placed, only 50 yards distant, contained not a single specimen. This was the more remarkable, as we often saw natives carrying over raw meat to the opposite bank with many *tsetse* settled upon it. The poison does not seem to be injected by a sting, or by ova placed beneath the skin, for when one is allowed to feed freely on the hand, it is seen to insert the middle prong of three portions, into which the proboscis divides, somewhat deeply into the true skin; it then draws

it out a little way, and it assumes a crimson colour as the mandibles come into brisk operation. The previously shrunken belly swells out, and if left undisturbed the fly quietly departs when it is full. A slight itching irritation follows, but not more than in the bite of a mosquito. In the ox, this same bite produces no more immediate effects than in man. It does not startle him as the gad-fly does; but a few days afterwards the following symptoms supervene: the eye and nose begin to run, the coat stares as if the animal were cold, a swelling appears under the jaw, and sometimes at the navel; and, though the animal continues to graze, emaciation commences, accompanied with a peculiar flaccidity of the muscles, and this proceeds unchecked until, perhaps months afterwards, purging comes on, and the animal, no longer able to graze, perishes in a state of extreme exhaustion. Those which are in good condition often perish soon after the bite is inflicted with staggering and blindness, as if the brain were affected by it. Sudden changes of temperature produced by falls of rain seem to hasten the progress of the complaint; but in general the emaciation goes on uninterruptedly for months, and do what we will, the poor animals perish miserably. When opened, the cellular tissue on the surface of the body beneath the skin is seen to be injected with air, as if a quantity of soap bubbles were scattered over it, or a dishonest awkward butcher had been trying to make it look fat. The fat is of a greenish-yellow colour and of an oily consistence. All the muscles are flabby, and the heart often so soft that the fingers may be made to meet through it. The lungs and liver partake of the disease. The stomach and bowels are pale and empty, and the gall-bladder is distended with bile. The symptoms seem to indicate what is probably the case, a poison in the blood; the germ of which enters when the proboscis is inserted to draw blood. The poison-germ, contained in a bulb at the root of the proboscis, seems capable, although very minute in quantity, of reproducing itself, for the blood after death by *tsetse* is very small in quantity, and scarcely stains the hands in dissection. I shall have by and by to mention another insect, which by the same operation produces in the human subject both vomiting and purging. The mule, ass, and goat enjoy the same immunity from the *tsetse* as man and the game."

Scarcely less surprising is his account of African Melons. "But the most surprising plant of the Desert is the 'Kengwe or Keme' (*Cucumis caffer*), the Water Melon. In years when more than the usual quantity of rain falls, vast tracts of the country are literally covered with these Melons; this was the case annually when the fall of rain was greater than it is now, and the Bakwains sent trading parties every year to the lake. It happens commonly once every 10 or 11 years, and for the last three times its occurrence has coincided with an extraordinarily wet season. Then animals of every sort and name, including man, rejoice in the rich supply. The elephant, true lord of the forest, revels in this fruit, and so do the different species of rhinoceros, although naturally so diverse in their choice of pasture. The various kinds of antelopes feed on them with equal avidity, and lions, hyænas, jackals, and mice, all seem to know and appreciate the common blessing. These Melons are not, however, all of them eatable; some are sweet, and others so bitter that the whole are named by the Boers the 'Bitter Water-melon.' The natives select them by striking one Melon after another with a hatchet, and applying the tongue to the gashes. They thus readily distinguish between the bitter and sweet. The bitter are deleterious, but the sweet are quite wholesome. This peculiarity of one species of plants bearing both sweet and bitter fruits occurs also in a red eatable Cucumber often met with in the country. It is about 4 inches long, and about 1½ inch in diameter. It is of a bright scarlet colour when ripe. Many are bitter, others quite sweet. Even Melons in a garden may be made bitter by a few bitter Kengwe in the vicinity. The bees convey the pollen from one to the other."

Decandolle's Prodromus Systematis naturalis Regni Vegetabilis.—We have just received the second part of the fourteenth volume, comprehending Thymelœaceœ by Meisner, and Santalaceœ by Alph. deCandolle, two volumes more are expected to complete the Exogens. Professor Anderson undertakes the difficult task of elucidating the Salicaceous order. Dr. Buek of Hamburg, to whom Botanists were indebted for an admirable index of the first seven volumes, has now in the press a second index up to the end

of the 13th volume, thereby doing good service to the cause of Botany. It is computed that the 14 volumes actually completed, contain 50,509 species, arranged in 4,525 genera. The first volume was commenced in 1822. When the work is finished, we will have a complete systematical account of all plants known at the time of publishing the several volumes.

Hooker's Journal of Botany.—We find from the December Number of the *Kew Miscellany*, that Sir William Hooker's very useful Journal has ceased to appear. Under one form or another this veteran Botanist has published since 1827, much of his most interesting correspondence with men of Science and travellers of every grade and in every clime. We fear that the cessation of this periodical will be felt by very many besides ourselves. The Journal of the Linnean Society, and the Annals of Natural History in London, and the New Philosophical Journal in Edinburgh are now the remaining media through which communications on Natural History may be brought before the public.

Journal of the Proceedings of the Linnean Society.—Six numbers of this admirable serial have reached us, appearing quarterly and containing papers on Natural History read before the Society, and not inserted in its "Transactions." The Zoological and Botanical Papers are separately paged, so that either section may be taken separately.

The "Journal of Proceedings" for the present year is sold to the public at 12*s*. for the entire Journal, or 8*s*. for either the Zoological or Botanical section taken separately; the separate numbers being charged 3*s*. for the whole, or 2*s*. for either section. There are some valuable Zoological papers by Professor Owen and others—and a series of sketches of the Natural Families of Indian Plants, "*Prœcursores ad Floram Indicam*," by J. D. Hooker, M. D., and T. Thomson, M. D., which we hope to give in the selections of our next number.

The Plant Scenery of the World; a Popular Introduction to Botanical Geography.—By John H. Balfour, A. M., M. D., &c., and Robert Kaye Greville, L. L. D., &c. with Illustrations.

We are enabled to announce with great pleasure the prospective appearance of this work, which is intended to illustrate something in the style of Humbold's "Aspects of nature," the physiognomic effect of certain species, and families of plants in representing the scenery of different parts of the Globe. The descriptions will be accompanied with Chromo-lithographs of great artistic merit.

Any persons possessing drawings or photographs of interesting plants, such as would be easily recognized in a picture, will confer a benefit upon the authors by permitting them to be copied. The Editors of this Journal will be happy to receive, and forward any such contributions.

PROCEEDINGS.

The Managing Committee of the MADRAS LITERARY SOCIETY *and Auxiliary of the Royal Asiatic Society, Thursday evening, November* 12*th*, 1857.

After the usual accounts exhibiting the state of the Society's Funds, the Secretary read a letter from Lieut. H. P. Hawkes, drawing the attention of the Society to the facility afforded by the electrotype process for obtaining perfect fac-similes of Coins, Seal rings, Cameos, &c. The three specimens forwarded, one from a Gutta Percha Medal, one from a Cameo, and the third from a Cliche Medal were laid upon the Table and attracted much notice. The impression from the Medal especially was found to be very sharp, and the manipulation of all appeared very creditable.

Mr. Hawkes having understood that the Society had under consideration the advisability of purchasing the Stacey Collection of Coins, kindly proposed, should any coins be found wanting to complete a series, to make electrotype impressions of such of the missing coins as might be found in private Cabinets, and to complete the Society's collection.

Resolved to inform Mr. Hawkes that it was the Asiatic Society of Calcutta that had in contemplation the purchase of the Stacey

Collection, and that this Society was only requested to aid in the same. The Committee nevertheless appreciate Mr. Hawkes' kind offer.

Read a letter from Mr. H. Smith, Superintendent of the Government Press, soliciting the publication in the Society's Journal, of certain specimen copies of Plants* in illustration of a new development of Nature printing. In addition to the impressions forwarded with the letter, a large folio book of illustrations was laid upon the table, and attracted great admiration. In clearness, in sharpness of outline, and in accuracy of representation Mr. Smith's process particularly excels.

The most successful representations appear to be those of the Ferns, Grasses, and specimens requiring minute and delicate outline, like *Mollugo Cerviana*, the impression of which is admirable; or complicated details such as the reticulated venation of leaves. But Mr. Smith's excellence of manipulation has also enabled him to overcome the difficulty of printing from the most succulent and fleshy plants. The print of the common *Yercum* or *Madar* (*Calotropis gigantea*) is particularly happy and exhibits clearly all the botanical details. A leaf of the prickly pear (*Opuntia Dillenii*) is equally successful. He has even carried his experiments into the animal kingdom, and exhibits printed pictures of a Snake and a Bat, the characteristics of which are shown with surprising clearness.

Considerable discussion arose in the Meeting as to how far the discovery is due to Mr. Smith. Mr. S. in his letter gives a precis of the different processes of Nature printing that have been at various times resorted to, and claims for his own plan that it excels all others in simplicity and efficiency, and is capable of a much more extended application. Its distinctive peculiarity, he tells us, consists in the impressions being obtained direct from fresh unprepared plants. Mr. Burgass however recollects similar impressions being exhibited two or three years ago at the Polytechnic at Home, but not being aware of the exact modus operandi, which is part of

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* Vide Plates 5 and 6 of this Number.

the point at issue, he cannot positively pronounce as to what credit Mr. Smith is entitled to in the question of discovery.

Major Wilson observed that the process referred to by Mr. Burgass was probably that exhibited by Mr. Cox at the Polytechnic Institution under the name of the Foliographic Press, for Printing from fresh leaves and plants. Major Wilson stated that one of these Presses was in his possession, and that he had frequently taken impressions of leaves with it, the process appearing to be identical in all respects with that described in Mr. Smith's paper. Major Wilson sent for the prospectus of Mr. Cox's invention, of which the following is a copy :—

" The Foliographic Press for printing from Nature being a new and exceedingly simple machine for printing *fresh* leaves, ferns, feathers, lace &c., invented and sold by G. I. Cox, at 134, Great College Street, Camden Town, and the Royal Polytechnic Institution. Press, Roller, Pot of Ink, and Sheet of Carbonised Paper 5*s*. 6*d*. small ; 8*s*. 6*d*. large."

Direction for use.

" Put a leaf between the fold of the Carbonised paper. Pass the Roller five or six times over each outside surface ; open the fold and extract the leaf, which has now become impregnated with ink. Then place it between the fold of a clean sheet of writing paper, which is now to be introduced under the leather flap and pressed by passing the roller once over the surface, when an accurate and beautiful impression will be the result.

The carbonised paper is made by dabbing the ink evenly over the surface of ordinary writing paper, with a dabber made of wash leather.

It is advisable, previous to using a leaf, to roll it slightly between a sheet of blotting paper, to absorb the extraneous damp or moisture."

The Meeting were of opinion that the principle of both processes was the same, but Mr. Smith has the merit of having develop-

ed its application more fully, so as to obtain larger and finer pictures as well as of having extended it to more difficult objects; and particularly to reptiles and animals, which seems not to have been attempted before.

The Committee beg to acknowledge, with thanks, the receipt of the following books and papers:

From the Chief Secretary.

1. Geological Papers on Western India.
2. Atlas do. do.
3. Selections from the Records of the Madras Government, Railway Correspondence.
4. do do India No. 23 on Tea Cultivation.
5. Indian Journal of Arts and Sciences, Vol. 1, No. 4.
6. Cyclopædia of India, Parts 8, 9 and 10.
7. Description of the method of catching Wild Elephants in the Coimbatore District, by Captain D. Hamilton.

From the Government of Bombay.

8. Bombay Magnetical and Meteorological Observations for 1856.

From the Authors.

9. Note sur Les Rubaiyat de Omar Khaiyam par M. Garcin de Tassy.
10. La poesie Philosophique et Religieuse chez les Persans, d'apres le mantic uttair, ou Le Langage des Oiseaux de Farid Uddin Attar par M. Garcin de Tassy.

The Managing Committee of the MADRAS LITERARY SOCIETY *and Auxiliary of the Royal Asiatic Society*, 10*th December*, 1857.

Mr. Elliot read a notice of the Gold Coins stated at page 114, Volume I, new series of the Journal, to have been found at Madura. They comprise 49 specimens, of which 28 have been bought for the Government Central Museum, 20 were purchased by a Gentleman at Madura and sent home, and a single one was obtained by Mr. Elliot himself. The whole are gold pieces of the kind called *aurei*, belonging to the times of the earlier Cæsars from Tiberius to Domitian, as follows:

Of Tiberius 6, Claudius 8, Agrippina 3, Elder Drusus 2, Younger Drusus 5, Nero 17, Caligula 1, Domitian 5, Nerva 2.

The Secretary read some interesting Remarks by Mr. Jesse Mitchell on the distribution of fresh water *Polyzoa.*

Mr. Mitchell observes that Professor Allman in his recent work entitled " a Monograph of the Fresh Water *Polyzoa*," has stated that although found at an altitude of 6000 feet, these *Infusoria* are not met with beyond the limits of the temporate Zone. Now, Mr. Mitchell has himself taken them in Madras, and gives a very interesting description of one he captured in considerable numbers adhering to the roots of the common Duck weed or *Lemna* in the month of September last.

These when placed in a Polyp-trough under a one inch objective, exhibited groups of Polyzoa inhabiting tubular cells attached to the root of the plant and to each other. The head of the animal which was transparent and hyaline and furnished with a double row of ciliœ upwards of forty in number, was protruded from the cell in the act of feeding, and the whole process of capturing, swallowing and digesting its prey was distinctly visible. It seemed to prefer the smaller kind of Infusoria rejecting the large Rotatoria, which were drawn into the vortex of the ciliœ by their rapid motion, an operation which it effected either by driving off the intruder by blows of the tentacula, or if this failed by retiring into the cell, when the vibratile action of the ciliœ was suspended and the unwelcome visitor escaped. Mr. Mitchell believes that both this and other species will be found abundantly on the roots of Lemna and other fresh aquatic Plants.

The Committee beg to acknowledge with thanks the receipt of the following books.

From the Chief Secretary.

1. Cyclopædia of India, Parts 11, 12, 13, 14 and 15.
2. A Treatise on the Small Pox, by W. C. Maclean, Esq., M. D.
3. Extract from M. C., relative to Silicate of Soda and Lime as a Protective from Fire.

4. Catalogue of the Government Central Museum.
5. Report on the Railway Department.
6. Report on the Civil Dispensaries.
7. On Indian Infanticide, by the Rev. John Cave Brown.
8. Report on a reputed Coal Formation at Kotah, by P. W. Wall, Mineral Viewer.

Extract from Meteorological Observation

DAILY

Date.	October 1857. Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Means. Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Ins.	
1	29·831	84·9	78·1	95·6	79·2	S	0 032	Hazy
2	.851	82·0	77·0	92·5	72·4	E S E	·750	Clody.
3				93·2	76·8	S S W	....	
4	·880	83·1	77·2	94·6	79·1	W N W	....	do
5	·885	83·8	77·3	96·2	78·2	S S W	....	Hazy
6	·856	84·0	77·7	92·9	79·8	S E	...	do
7	·876	83·4	77·2	91·0	78·8	E	....	Clear.
8	·901	83·3	76·7	92·0	78·5	E by S	....	Hazy
9	·905	83·3	76·8	91·6	79·0	E	....	do
10				90·9	79·4	E by N	·013	
11	·860	79·0	75·4	88·6	75·4	N	3·391	Clody.
12	·833	77·0	74·8	85·8	75·4	N N E	0·667	Ovcst.
13	.881	79·5	76·3	88·3	77·1	E S E	·981	do
14	·947	76·6	74·9	84·5	75·4	N by E	3·073	do
15	·891	76·8	74·8	85·2	75 1	N N E	1 292	do
16	·884	79 3	76·5	88 0	76·7	E	0·152	Clody.
17				87·9	77·1	E	....	
18	·888	80·0	76·8	87·8	77·0	S E	·022	Hazy
19	·885	80·2	76·4	88 8	77·2	E	·208	Clody.
20	.879	80·5	77·0	88·1	77·3	N E	·465	do
21	·886	77·7	75·3	82·4	75·0	N N E	·955	Ovcst.
22	·871	78·2	74·9	82·3	75·9	E by N	·573	do
23	·848	75·1	73·7	79·3	74·1	N N W	4·165	do
24				79 0	73·6	N W	18·039	
25	·740	75·0	74·5	78·2	74·4	N	2 813	do
26	·760	76·7	74·9	81·3	75·7	N N W	0·125	do
27	·793	78·4	75·1	86·3	76·5	?	....	do
28	·796	78 ·3	74·1	85·1	75·3	?	....	do
29	·805	76 ·6	72·[illegible]	84·9	72·6	N N W	....	do
30	·784	76·3	72·2	80·8	74·4	W by N	....	do
31				82·0	74·5	W N W	·010	
Mean.	29·854	79·6	75·7	87·3	76·4		37·726 Sum	

Date.	November. Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Means. Wet	Max.	Min.
	Inches	°	°	°	
1	29 739	77·8	72·4	87·5	75
2	·851	75·8	76·2	87·6	77
3	916	80·1	76·8	87·5	77
4	·921	79·7	76·5	88·2	76
5	·919	79·7	76·6	86·3	77
6	·913	78·4	74·6	86·1	74
7				85·6	74
8	·961	77·7	72·0	83·8	73
9	·973	77·5	70·8	83·9	74
10	·949	76·2	70·7	83·1	7
11	·991	76·1	69·1	82·7	71
12	30·041	75·8	69·1	83·6	71
13	·049	76·6	68·3	84·0	72
14				83·8	72
15	·017	75·2	71·7	80·8	72
16	·022	77·0	74·3	84·3	74
17	29·992	77·9	73 3	83·2	76
18	·987	76·7	71·8	82·2	73
19	·980	75·6	71·0	81·3	72
20	·963	74·6	69·2	81·1	70
21				80·5	69
22	·905	74·3	68·0	82 3	72
23	·903	75·9	71·7	83·0	72
24	·929	75·8	70·3	82·5	70
25	·896	74·3	68 8	82·2	69
26	·892	74·2	69 4	84·3	68
27	·949	76·2	72·1	84·2	71
28				84·3	7
29	·995	76·1	71·4	83·4	70
30	·999	75·1	68·7	82·6	69
31					
Mean.	29·948	76·6	71·7	83·9	72

? This mark signifies that no Means can be tak

pt at the Madras Magnetic Observatory.

ANS.

7.			December 1857.									
	Rain.	Remarks.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.	
	Ins.		Inches	°	°	°	°		Ins.		
y s	0·071	Ovcst	30·029	75 7	68·7	81·9	71·2	N E	...	Hazy	1
w	·013	Clody.	·038	75 9	68·5	82 2	70·3	N E	....	do	2
y E	....	do	·040	74·5	67·5	82·1	69·5	N N E	....	do	3
E	·319	do	·066	75·3	66·5	83·1	70·2	N E	....	do	4
E	....	do				81·3	70·7	N N E	0·006		5
E	....	Clear.	·013	75·1	66·8	81·7	70·6	N N E	·022	Clody.	6
E	....	·	29 977	71.7	64 8	80.7	65·8	N	....	Hazy	7
N E	....	Hazy	·989	72·4	65·2	80.3	69·5	N by E	....	Ovcst.	8
N E	....	Clody.	·987	71.3	65·1	80·1	66·3	N by E	....	Hazy	9
E	....	Hazy	·923	71·3	66 8	75·2	68·8	N N W	·202	Ovcst.	10
E	....	Clear.	·941	76 3	74 1	84·6	73·3	E N E	·315	do	11
E	....	Hazy				84·1	70 6	E by S	....		12
E	....	do	30·024	75 9	73·7	83·2	73 6	N E	·012	Hazy	13
E	....		·037	75·7	72.7	83 4	72·3	N E	....	Clear	14
N	4·205	Clody.	·018	74·8	71·3	82·1	70·5	E by N	....	do	15
E	0 9'0	Ovcst.	·009	73·0	68.9	81·9	67·4	?	....	do	16
E	. .	Hazy	·026	74.1	68·2	82·6	68 4	E by N	...	do	17
E	....	Ovcst.	·007	73·5	68·6	82 6	69·9	N E	·380	Hazy	18
y E	·309	do				82 5	72 3	E N E	·058		19
E	....	Clody.	29·997	74·6	70·7	81·7	72·3	N E	....	Ovcst.	20
	...		30.015	76 0	69·1	81 6	74·1	N E	. ..	Hazy	21
	·003	Hazy	·021	75·5	66.4	81·6	74·1	N E	....	Clody.	22
E	...	Clody	·009	73 2	67 1	80·8	69·1	N N E	....	Hazy	23
E	...	Hazy	·039	75·2	66 6	81·3	72 2	E N E	...	do	24
E	...	Clear	·058	75·6	65 7	81·8	73·6	N E	....	Clody.	25
	....	do				81·0	69·1	E N E	...		26
E	....	do	·015	72·6	66·2	80·5	67·8	N N E	...	Hazy	27
E	...		·063	75·1	68·4	81·2	72·3	N E	...	Clody.	28
13	....	Clear.	·079	74·0	68·4	81·6	69.2	N N E	....	Hazy	29
13	....	do	·083	76·0	70·6	81·8	73·5	N E	....	Ovcst.	30
	....		·085	75·4	70·0	81·7	71·3	N E	....	Clody.	31
	5·820 Sum		30·023	74·4	68·4	81·7	70·6		0·995 Sum		Mean.

ing to the variable state of the Wind.

Extract from Meteorological Observations kept at the Madras Magnetic Observatory.

HOURLY MEANS.

Gottingen Mean Time		Noon	1	2	3	4	5	6	7	8	9	10	11
Madras Mean Time		P. M. h 4 m 41	h 5 m 41	h 6 m 41	h 7 m 41	h 8 m 41	h 9 m 41	h 10 m 41	h 11 m 41	h 12 m 41	h 13 m 41	h 14 m 41	h 15 m 41
Bar. at 32° Fr. 1857		In.	In.	In.	In.	In.	In.	In.	In.	In.	* In.	In.	* In.
	Oct.	29·804	29·818	29·836	29·862	29·884	29·892	29·887	29·874	29·859	29·841	29·830	29·827
	Nov.	·899	·916	·938	·962	·976	·982	·970	·962	·947	·932	·921	·919
	Dec.	·978	·993	30·013	30·035	30·053	30·058	30·050	30·037	30·025	30·009	·996	:992
Dry Ther. 1857		°	°	°	°	°	°	°	°	°	°	°	°
	Oct.	82·0	80·9	80·0	79·7	79·3	78·8	78 2	77·8	77·0	76·8	76·6	76·4
	Nov.	79·1	77·8	76·9	76·6	76·1	75·8	75·5	75·0	74·5	73·8	73·2	72·9
	Dec.	76·8	75·7	74·8	74·2	73·9	73·5	73·0	72·5	72·0	71·5	71·0	70·8
Wet Ther. 1857	Oct.	76·5	76·3	76 1	76·1	76·2	75·8	75·5	75·4	74·8	74·7	74·7	74·4
	Nov.	72·3	72·0	71·8	71·7	71·5	71·4	71·3	71·2	71·3	71·1	71·0	70·8
	Dec.	69·2	68·8	68·5	68·4	68·2	68·1	68·0	67 7	67·6	67·5	67·4	67·4

Gottingen Mean Time		12	13	14	15	16	17	18	19	20	21	22	23	Means.
Madras Mean Time		h 16 m 41	h 17 m 41	h 18 m 41	h 19 m 41	h 20 m 41	h 21 m 41	h 22 m 41	h 23 m 41	h 0 m 41	h 1 m 41	h 2 m 41	h 3 m 41	
Bar. at 32° Fr. 1857		In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
	Oct.	29·834	29·850	29·875	29·897	29·910	29·912	29·896	29·865	29 ·841	29·815	29·800	29·799	29·854
	Nov.	·927	·946	·966	·990	30·008	30·007	·991	·963	·933	·909	·897	·897	·918
	Dec.	30·000	30·015	30 033	30·058	·078	·080	30·066	30.042	30·013	·985	·971	·969	30.023
Dry Ther. 1857		°	°	°	°	°	°	°	°	°	°	°	°	°
	Oct.	76·1	76 0	76·3	78·0	80·1	81·4	82·6	83·3	83·7	83·6	83·1	82·4	79·6
	Nov.	72·5	72•2	73·0	75·0	76·8	78·4	79·9	81·2	81·5	81·5	81·2	80 3	76·6
	Dec.	70·5	70·3	70·3	72·4	75·0	76·9	78·0	78·6	79·1	78·7	78·4	77·7	74·4
Wet Ther. 1857	Oct.	74·1	74·2	74·3	75·1	76·0	76·2	76·4	76·5	76·7	76·9	76·7	76·4	75·7
	Nov.	70·5	70·2	70·5	71·2	71·8	72·2	72·6	73·1	73·2	73 2	73·1	72·6	71.7
	Dec.	67·3	67·2	66·9	67·7	68·6	69·4	69·6	69·6	69·7	69·5	69·6	69·4	68 4

* The Numbers in these Columns are not observed but interpolated for the sake of obtaining the daily Means.

W. S. JACOB,
Hon'ble Company's Astronomer.

XI. *Extract from Report on the Vegetable Products of the Pulney Hills. By* Lieut. R. H. Beddome, *Assistant Conservator of Forests.*

(Communicated by the Madras Government.)

I have completed my tour in the Pulney range, and have thoroughly explored all the slopes and the forests on them. In many places, there has at one time been a considerable quantity of Teak, and Blackwood (*Dalbergia latifolia*, and *D. sissoides*,) also on the northern slopes, Cungilium (*Shorea robusta*,) almost all the large trees of these timbers have been long since felled. Teak and Blackwood saplings are yearly springing up, these are felled, when their scantling is about that of a man's arm, and used as posts, &c., the natives prizing the Teak especially as they say, that the white ants will not touch it. Whilst I was at Pulney, I saw ten young Teak saplings, none of them perhaps thicker than my arm, brought in by the woodcutters, and sold to an overseer as posts for a shed that he was building near the public bungalow, saplings that would have yielded magnificent timber years hence. On the slopes near Pulney, and between that place and Verupatchy, I observed a great quantity of timber cut and being carted away, chiefly Vengay, (*Pterocarpus marsupium*,) and Veckalie (*Conocarpus latifolius*,) some logs of good size. On the lower slopes in this direction, there is a scattering of Teak. There is also Blackwood, of this tree I observed a great many saplings, about the foot of the ghat which ascends to Cowajee, and for some way up the rocky slopes, they are being felled, however, by the wood cutters. I saw one large tree of this timber being carted away from the jungles, though I did not succeed in finding any trees of size, standing.

Ascending to Poombary from Pulney there is a very extensive alpine basin with high hills all round, in this, and the ravines and valleys formed by the spurs to the West of it, below Ulloorankunvay, I found no Teak : the timber, particularly in the large basin, has been much destroyed.

Note.—Dr. Wight visited the Pulney Hills, his observations will be found in this Journal, Vol. V. p. 280, (1837.)

The timber here is chiefly the following :

Pterocarpus marsupium. (Vengay.)
Conocarpus latifolius. (Veckalie.)
Grewia tiliæfolia (Tarradâ.)
Emblica officinalis.
Briedelia.
Terminalias, 2 : scarce.
Acacia Sundra (Baga.)
Acacia odoratissima.
Dalbergia latifolia (Todakuttay) scarce and poor.

Of the two Acacias, I observed several trees that had been felled and were being cut into small logs.

On the slopes far down below Kookul in a northerly direction, the jungle has been much cut, there has at one time been a good quantity of Cungilium (*Shorea robusta*) in this locality, there are however, only a few poor trees now left standing. This timber is most greedily sought after by the Natives for house building. Further down on the spurs near the plains, and below a hill called the Koombootookee mallay, I found Teak.

I visited the Mungapatty valley, lying to the West of the Pulney range, here the timber has been much destroyed, to make way for cultivation. There is no Teak here. Down the slopes to the S. W. towards the Aggamullay hills, I found that the jungle had been much cut, the spurs in some places are pretty thickly wooded, but there is nothing of any value now standing. The slopes about Wollangum have been considerably cleared for cultivation. On the lowermost spurs and small rocky hills between this village and that of Vellay covay (near Periakolum) I found here and there straggling Teak trees, and signs of a good deal having been cut.

A good quantity of Teak has formerly been cut, about the pass from Periakolum up to the Kodakarnal, none however now remains.

All this Western portion of the Pulnies up to the Permaulmallay and Cowanjee comprizes the higher range, and is generally called the Verupatchy Hills.

The higher ranges are from six to seven thousand feet in height, the plateau at the top consists of undulating grassy Hills, similar to

the Neilgherries, the grass is short and every where dotted with beautiful Orchideous plants (amongst which *Platanthera Susannæ*, and *lutea* are very conspicuous,) *Ophelia*, *Exacum*, *Pedicularis*, *Gentiana* and many other plants peculiar to a high altitude. With the exception of the sholas, the higher ranges are free of any jungle or trees, save here and there a few scattered trees of "*Rhododendron arboreum.*"

There are a good many sholas up the higher range, chiefly situated, where there are springs or water-courses, some of these are very thick, and several of enormous extent, the three largest upon the higher range are. The Kookul shola (situated close to a village of that name) which extends over two hills, on the north Western face of the Pulnies. The Minmoordi cornal shola situated at Pattoor on the southern side, and a large shola situated between that and Kodacarnal. The timber in these sholas is extensively cut by the inhabitants of the Hills. The following are trees common in the sholas on the higher ranges.

Cyminosma pedunculata.
Millingtonia pungens.
Rhododendron arboreum.
Hedera obovata.
Hedera rostrata.
Hedera racemosa.
Mœsa Indica.
Myrsine capitellata.
Olea robusta.
„ Sp.
Cinnamomum iners. (much felled by the Natives.)
Magnolia.—? (a magnificent tree)
Michelia Pulniensis.
Syzygium. Sp.
Dodonæa Burmanniana.
Rottlera peltata.
„ tinctoria.
Pittosporum floribundum.
Bentinckia condapana.
Symplocos, Sp.

Lauraceæ. 4 large trees.

Elœocarpus oblongus.	Enormous trees.
Monocera glandulifera.	
Monocera tuberculata.	
Kooragoo marum.	?
Kooravoo.	?
Velle Ore.	?
Noorle.	?
Wellatos.	? (ploughs always made of this.)
Gnidium eriocephala.	

There were other trees not in flower, with which I am quite unacquainted, amongst these I have little doubt, there are valuable timbers to be discovered. The Lime and the Orange are also found apparently indigenous.

The chief products of the higher ranges are Rice, Mustard, Garlic, Wheat, Barley, Vendiam (*Trigonella Fœnum Græcum.*)

Tennay (*Setaria Italica*) together with Lablab vulgaris, Limes, Oranges, Peaches and a few Plantains are also grown. A great number of low country Natives, have settled on the Pulney Hills. The Hill tribes are the Poliars and the Koonoovers, these latter tribes are most abundant on the lower Pulnies.

From Cowajee which is situated at the foot of the Permaulmallay, the highest peak of the Pulnies, I descended to the lower range of the Pulnies, or as they are often called the Tandigoody and Verupatchy Hill, they are I should judge about 4 to 5000 feet above the sea, or perhaps rather more. In the Arepatty valley below the Permaulmallay there is a good deal of scattered jungle, the timber has been largely felled; the timber most common there, is the *Terminalia chebula*, the Vengay, (*Pterocarpus marsupium*) and the Veckalie (*Conocarpus latifolius.*)

The vallies between Vilputty and Cowajee are more or less wooded, I here also found Cungilium (*Shorea robusta*) but no good trees of it left standing. The Warre bàkee river runs through this valley and there is a fine fall. Near Pussinkud I saw a few large Teak trees, the only ones that have apparently escaped the general destruction. The slopes down to Tempollium are extensively wooded, and there is Teak and Cungilium, almost all destroyed, however,

the Cungilium is I know still cut, and I have no doubt the Teak saplings also when any are found worth cutting. On the slopes near Pullatoor, Sandal wood is also found in small quantities.

The lower Pulnies are much more wooded, than the higher range, they are almost every where covered with a rather stunted jungle of Trees. The following trees are most numerous.

Conocarpus latifolius (Veckalie.)
Terminalia chebula. Very abundant.
Bignonia xylocarpa.
Sterculia guttata.
Cathartocarpus fistula.
Emblica officinalis.
Erythrina Indica.
Sclerostylis atalantioides.
Atalantia monophylla.
Gmelina arborea.
Zizyphus xylopyrus.
Grewia tiliœfolia.
Canthium umbellatum.

The trees are *generally rather* stunted, I observed a good quantity of the black dammer tree (*Canarium strictum*) towards Tyempollium. The hill people never extract the dammer, and are apparently ignorant of the uses of the tree.

The cultivation on these lower ranges is very considerable, compared to that of the higher ranges, about Pumukad and Tantigoody, all the vallies are under cultivation.

The chief products of the lower ranges are Turmeric, Plantains, Mustard, Castor Oil, Vendiam. (Trigonella Fænum Græcum.)

Cumboo. (Penicillaria spicata.)
Ragee (Eleusine coracana.)
Varagoo (Panicum miliaceum.)
Tennay (Setaria Italica.)
Mangoes, Citrons, Limes, Oranges, Cardamoms.

The shola forests in the vicinity of Tandigoody and Perryoor are very extensive, and contain tress of enormous size. The black dammer and the wild nutmeg trees are abundant. These sholas, however, are daily disappearing before the Plantain groves. To prepare a Plantain grove, a large tract of shola is burnt down, this forms a fine soil for the Plantain, acres of fine shola are destroyed annually in this manner.

Near Tandigoody, Cardamoms are also cultivated to a great extent. To form a Cardamom grove the small trees and underwood are burned, but the larger trees are left standing.

The following plants yield valuable fibres for rope, &c., and are much used by the Natives in the lower ranges.

Kat murke nâr. (grows to a tree.).......Gnidia eriocephala.
Volca nâr..............................Grewia Asiatica.
Surke nâr..............................Grewia abutilifolia.

Artocarpus integrifolia is most abundant in all the sholas of the lower ranges, particularly at Perryoor and Paucheloor.

The following timbers are much used by the Natives here.
Nawâr .... (Eugenia jambolana.)
Maiglan...... (Vitex alata.)
Cottam pallam. (Terminalia catappa.)
Kammallâ.... (Gmelina arborea.)
Kaie.........? used for ploughs.
The timber of Gmelina is highly spoken of.

The mace round the wild nutmeg (Palmanee Kam) is used by Natives to color their teeth. A Beer is made from the raggee (*Eleusine*) the flowers of *Vitex negundo* are used as a hop to ferment it with. Into the toddy which they draw from the *Caryota urens*, (a tree very abundant here,) they fling in some of the bark of *Olea robusta* which immediately causes fermentation.

Girardinia Leschenaultiana, a plant yielding a valuable fibre is most abundant here, the natives however, are ignorant of its use.

The leaves of Dodonæa Burmanniana are bound on swellings produced by Sprains, &c., it is said with great effect, a decoction of the leaves is given internally in cases of leprosy.

Polygonum Sp.................. }
Acalypha Indica................. } used medicinally.
Flowers of Kalanchoe grandiflora. }

The sholas are very thick about Paucheloor and less destroyed, apparently than at Pandigoody. The black dammer tree is very abundant here. There has at one time been a good quantity of Teak on the slopes between Periyur and Verupatchy and also on the

slopes below Paucheloor, it is now almost entirely destroyed. There is Blackwood also, which is still at times cut and carted into Dindigul and Madura for sale. I did not myself observe any large trees of this timber standing, and as I was over a great portion of these jungles, there cannot be much left.

Flora of the Pulney Hills, as observed in September and October, 1857. *By* Lieut. R. H. Beddome.

Ranunculaceæ.

Clematis Gouriana,
,, Wightiana,
,, Munroii, sholas at Kodakarnal.
Anemone Wightiana,
Ranunculus reniformis,
,, Wallichianus, common.
Naravelia Zeylanica,

Magnoliaceæ.

*Michelia Pulniensis, very common (Shemboo.)
Magnolia sp. a beautiful tree common in sholas.

Anonaceæ.

Guatteria cerasoïdes,

Schizandraceæ.

Hortonia sp. near Perryar.

Menispermaceæ.

Cocculus villosus, lower slopes.
,, glaber,
,, macrocarpus ? (only in fruit.)
Clypea hernandifolia, very common.

Note.—Local Catalogues such as this "Flora Pulniensis" are of great use, illustrating the Geographical distribution of the plants of Southern India, and are specially commended by Dr. Royle in his observations on Provincial Exhibitions. —Ed. M. J.

* *M. Nilagirica* (Zenker) in Hooker and Thomson's Flora Indica.

BERBERIDACEÆ.

Berberis tinctoria,
,, Leschenaultii, 5,000 to 8,000 ft.

CRUCIFERÆ.

Nasturtium Madagascariense,
Cardamine Borbonica,
Sinapis juncea,

CAPPARIDACEÆ.

Gynandropsis pentaphylla,
Cleome monophylla,
Polanisia icosandra,
Cadaba Indica,
Capparis horrida, } lower slopes.
,, incanescens, }
,, grandis,

RESEDACEÆ.

Reseda alba, common about Kodakarnal.

FLACOURTIACEÆ.

Flacourtia sapida, slopes towards Verupatchy.
Hydnocarpus inebrians,

VIOLACEÆ.

*Viola odorata, scentless. } very common on the higher ranges.
,, Patrinii, }
Ionidium enneaspermum,

DROSERACEÆ.

Drosera peltata,
Parnassia Mysorensis, common in moist ground near Kodacarnal.

POLYGALACEÆ.

Polygala arillata, { very coammon shrub, 5,000 feet and upwards.
,, Wallichiana, { abundant in the grass on the highest ranges.
,, ciliata,
" rosmarinifolia,
" Wightiana ?
" nov. sp. ? a small shrub, slopes near Periyur.

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* *Viola Wightiana,* (Wall.)

CARYOPHYLLACEÆ.

Stellaria media, Cerastium Indicum,	moist places on the highest ranges, very common.
Arenaria sp.	
Mollugo ? sp.	

MALVACEÆ.

Urena sinuata,	
„ lobata,	used by the Natives as a fibre.
Pavonia Zeylanica,	covered with clammy pubescence.
Lebretonia procumbens,	lower slopes.
Hibiscus micranthus,	do.
„ hirtus,	do. white variety.
„ lampas,	very abundant.
„ Surattensis,	lower slopes.
„ aculeatus, (*Roxb.*)	This is H. furcatus, (*W.* and *A.*) but very different from H. furcatus, (*Roxb.*) a plant common in Central India.
„ canescens,	slopes near Pulney.
„ sp.	(near Vellay covay) erect, shrubby, covered all over with shining hairs, leaves cordate, serrate, 3-5 lobed, petioles the length to twice the length of the leaves, involucel 4 to 7 leaved, generally 5, segments narrow, acuminate, calyx deeply 5 cleft, segments 3 nerved, acuminated, purple streaked. Flowers short peduncled, axillary, afterwards in terminal racemes, elongated. Seeds glabrous with a few tufts of hairs. Perhaps "H. lunarifolius" but the involucel is generally 5 leaved never 10, the calyx is like that of "canescens."
„ eriocarpus,	slopes towards Pulney.

Abelmoschus angulosus, *W. A.*	The involucel is spathiform, and splits into 4 leaves, I have however often observed it in 4 leaves from the commencement, and never assuming the form of a spathe, I believe it to be the same as Hibiscus tetraphyllus, (Roxb.) which is common in central India.
,, moschatus,	
Lagunea lobata,	
Abutilon polyandrum,	much valued as a fibre.
,, Asiaticum,	slopes.
,, Indicum,	do.
Sida humilis,	do.
,, acuta,	do.

BOMBACEÆ.

Sterculia guttata,	yields a fibre, which is hardly distinguishable from that of "S. villosa," the valuable Elephant rope of the Anamallays.
,, urens,	
Kydia calycina,	
Eriochlæna Hookeriana,	Lower ranges, very abundant.

TROPÆOLACEÆ.

Tropæolum sp.	very abundant. near Poombary, run wild?

TILIACEÆ.

Corchorus trilocularis,	
Triumfetta sp.	
Grewia abutilifolia,	(Surke nâr) used as a fibre.
,, villosa,	
,, tiliæfolia,	
,, salvifolia,	
,, Asiatica,	(Valce nàr) used as a fibre. At the Anamallays, valce nàr is applied to Sterculia villosa.

Grewia hirsuta,
,, sp. Leaves roundish, rhomboid, 3 nerved, cordate at base, unequally toothed, slightly scabrous, peduncles axillary, 1, 2 flowered longer than petioles, bracteoled at base, sepals twice as long as petals, recurved, petals sharply bidentate, stigma 2 lobed, style clavate at apex, longer than stamens, nuts 1-3 shining.

ELÆOCARPACEÆ.

Elæocarpus oblongus,
Monocera tuberculata, } very large trees, in sholas.
,, glandulifera, } Do. glands not always present.

DIPTEROCARPEÆ.

Vatica sp. (Cungilium) vallies amongst the hills and slopes. Wood much prized by the natives.

TERNSTRŒMIACEÆ.

Cleyera gymnanthera, sholas.
Cochlospermum gossypium,

OLACACEÆ.

Gomphandra polymorpha, near Poombary.
Stemonurus fœtidus, do.

AURANTIACEÆ.

Atalantia monophylla,
Limonia acidissima, a very pretty wood.
,, alata, in sholas.
Glycosmis pentaphylla,
Feronia elephantum,
Aegle marmelos,
Citrus sp.
? .... { A very prickly climber, with ternate leaves, the fruit is eaten.

HYPERICACEÆ.

Hypericum Hookerianum, very common, higher ranges.

GUTTIFERÆ.

Garcinia sp. sholas.

MALPIGHIACEÆ.

Hiptage Madablota, near Tandigoody.

SAPINDACEÆ.

Cardiospermum canescens, lower slopes.
" halicacabum, " "
Sapindus emarginatus, " "
Dodonœa Burmanniana, { from the plains to the highest level, common also in the sholas.

MILLINGTONIACEÆ.

Millingtonia pungens, in sholas, common.

MELIACEÆ.

Melia azedarach, near Perryur.
Mallea Rothii,

CEDRELACEÆ.

Chloroxylon Swietenia, lower slopes.

AMPELIDACEÆ.

Vitis quadrangularis,
" setosa,
" tenuifolia,
" sp. { gland-tipped, deep purplish, serrated leaves.
" sp. Poombary valley.
" Rheedii,
" sp.

GERANIACEÆ.

Geranium affine, very abundant.

LINACEÆ.

Linum Mysorense, near Shambaganoor, common.

BALSAMINACEÆ.

Impatiens Balsamina,
" arcuata,
" Leschenaultii, in drying, this species tinges the paper a bright pink color. (Common at Kodakarnal.)

Impatiens albida,	common in hill streams 5,000, to 7,000 feet, grows to 16 or 18 feet high, flowers very large, of a delicate rose color. I never saw them white as described by Dr. Wight, nor does his plate give much idea of the plant, as it grows on these hills.
,, campanulata,	in sholas very common, 6,000 to 7,000 feet, flowers beautifully mottled with pink.
,, dasysperma,	capsule slightly pubescent! this species is readily known by the curved mucro at the conjunction of the 2 upper sepals.
,, nov sp.	sholas at Kodakarnal, 7,000 feet, glabrous, *leaves alternate*, lanceolate acute, petioled, bristly serrate, racemes as long or longer than leaves, 4 to 14 flowered pedicels, longer than petioles with a large cordate (convex on outside) bract at the base of each. 2 upper sepals winged at their conjunction. Spur long, incurved with gland-tipped point, flowers of a uniform crimson. A very beautiful sp: quite unlike any described or figured.
— —	*Impatiens Phenicea.*
,, tomentosa,	Kodakarnal about streams, the whole plant is sometimes quite glabrous, 7,000 feet.
,, fasciculata,	the commonest species on the hills.
,, viscida,	Kodakarnal in streams, 7,000 feet.
,, nov. sp.	(summit of Permaulmallay, in streams 8,000 feet.) Stems 4 angled, sulcated, slightly hairy, *leaves opposite*, serrate, long petioled above a few

hairs, below glaucous, peduncles, longer than the leaves, smooth *viscid*, bearing 7-9 flowering racemes at their apex, pedicels with a gland tipped filiform bract at their base, lateral sepals small, spur rather long, capsule gibbous, streaked with purple, flowers very small pink. A very small species, the whole plant not more than 4 inches high.

Impatiens Pulniensis.

OXALIDACEÆ.

Biophytum sensitivum,
Oxalis corniculata,

ZYGOPHYLLACEÆ.

Tribulus lanuginosus,	Lower slopes.

RUTACEÆ.

Cyminosma pedunculata,	sholas. (very common.)

ZANTHOXYLACEÆ.

Toddalia aculeata,	slopes towards Verupatchy.

PITTOSPOREÆ.

Pittosporum floribundum,	Poombary (common.)

CELASTRACEÆ.

Celastrus Heyneana,	(Poombary valley.)
Euonymus angulatus,	(sholas) a very elegant small tree.

RHAMNACEÆ.

Zizyphus glabrata,	slopes.
,, xylopyra,	,,
,, Œnoplia,	,,

TEREBINTHACEÆ.

Semecarpus Anacardium,	
Mangifera Indica,	lower Pulney ranges.
Odina Wodier,	do. do.

BURSERACEÆ.

Canarium strictum, { Abundant on the lower Pulnies, yields a black dammer, the natives however never extract it.

Garuga pinnata,

Protium Roxburghianum, leaves pinnate.

,, ? Leaves ternate, much used for hedges.

MORINGACEÆ.

Hyperanthera Moringa, about villages.

LEGUMINOSÆ.

Sophora glauca,

Crotalaria rubiginosa,

,, Wightiana, several forms of this, if they are all one species.

,, sp. Stipules wanting, leaves very narrow, linear, with their upper surface as well as whole plant densely covered with blackish hairs, vexillum with a tuft of hairs, otherwise similar to "anthylloïdes." Common near Poombary. (a form of anthylloïdes.)

,, anthylloïdes,

,, Mysorensis,

,, longipes? agrees well with the description of that plant, except that the legumes are pubescent, (a large shrub, common near Puttoor.)

,, paniculata, slopes near Pulney.

,, superfoliata, near Tandigoody.

,, juncea,

,, Leschenaultii, very common.

,, sericea,

,, montana, (*Roxb.*) (only differs from *sericea* in the stipules and bracts, but so far is constant.)

Crotalaria nov. sp. (6. Verrucosæ,) Herbaceous, erect, glabrous, leaves very narrow, linear, very obscurely nerved, tapering at the apex into a point. Stipules wanting, racemes terminal, many flowered, *bracts adnate to the rachis,* (as in the stipules of some Phaseoleæ,) ovate with a long acumination, calyx cleft to the middle, upper lip bifid, legume with a short thick stalk, oblong, broader upwards, glabrous, many seeded. Flowers yellow, a very distinct species, apparently new, a rare plant.

Crotalaria elegans.

„ Wallichiana, very common.

„ nov. Sp.? (6. Verrucosæ,) suffruticose, erect, leaves orbicular, smooth on the upper surface, *under surface and stems densely covered with white woolly hair*, stipules very large, lunate, transverse, racemes terminal, calyx (cleft to the middle, upper segment bifid,) pubescent, bracts ovate with a long acumination, *legumes glabrous*, many seeded, flowers yellow. 12 to 15 feet. Poombary ghât.

Crotalaria lanata.

„ (7 Diffusæ,) A very pretty procumbent species, with hirsute legume, very common amongst the grass at Poombary and elsewhere, with very long terminal racemes of large brilliant yellow flowers, perhaps a form of "C. Evolvuloides."

„ nov. sp. ? Herbaceous, erect, much branched, glabrous leaves lanceolate.

„ Acuminated, attenuated at the base. *Stipules wanting* racemes terminal or

axillary, few flowered, bracts minute, calyx cleft to the middle, upper segment deeply bifid, legumes oblong, broader upwards, pubescent 12 seeded, flowers blue, (has much the appearance of *C. verrucosa* at a distance, but has no stipules, and the leaves differ much,) a rare plant, near Cowanjee.

Crotalaria coerulea,

This species is very common on the Anamallays.

,, albida,	common.
,, viminea,	
,, globosa,	
,, umbellata,	near (Shambaganoor.)
,, Notonii,	near Vilputty.
,, clavata,	Periyur slopes towards Canavaddy.
,, Grahamiana,	Poombary valley (very common.)
Trigonella Fænum grœcum,	much cultivated.
Pycnospora nervosa,	(not common.)
Indigofera viscosa,	
,, pulchella,	a very common shrub.
,, tenuifolia,	
,, trifoliata,	
,, parviflora,	
,, Wightii,	
,, sp.	
Clitoria Ternatea,	
Dumasia congesta,	very common.
Shuteria vestita,	} ? perhaps these 2 species might be united.
,, glabrata,	
Notonia (Johnia) Wightii,	lower Pulnies.
Pseudarthria viscida,	,, ,, very common.
Tephrosia tinctoria,	
,, purpurea,	

Smithia sensitiva,	
,, racemosa?	Poombary ghát.
Uraria hamosa,	abundant lower ranges.
Desmodium triquetrum,	
,, latifolium,	
,, Gangeticum,	
,, Wightii?	
,, recurvatum,	
,, gyrans,	
,, polycarpum,	
,, rufescens,	very common 4,000 to 7,000 feet.
,, strangulatum,	very common.
,, triflorum,	
,, parvifolium,	
Dicerma pulchellum,	
Alysicarpus bupleurifolius,	
,, styracifolius,	
Abrus precatorius,	
Rhynchosia densiflora,	lower slopes.
,, (Phyllomatia), sp.	Calycine segments longer than the 1 seeded legume.
,, suaveolens,	at Punnikal.
Flemingia congesta,	
,, Grahamiana,	
Phaseolus Pulniensis,	a pretty sp. in the grass near Poombary and Kookul. Flowers lilac, large, fragrant.
,, trinervius,	
,, sublobatus,	
,, sp.	twining to a great extent, stipules adnate, stems strigose, leaves on long petioles, trifoliate, terminal one ovate oval, lateral ones obliquely ovate, very unequal sided, above harsh adpressed pubescence, below downy, peduncles longer than petioles, thickened, 3-4 flow-

ered at apex, flowers from glandular knobs, legumes terete, covered with brown hairs. Flowers very large, lilac and fragrant, very common. Can this be P. caracalla ? It is certainly wild.

„ trilobus,

„ sp. (Poombary valley) flowers white, legumes compressed.

Dolichos glutinosus, (Poombary valley.)

„ Sinensis,

Lablab vulgaris,

Parochetus major, moist ground, higher ranges.

Canavalia gladiata,

„ virosa,

„ mollis,

Mucuna (Citta) atropurpurea, at Tandigoody.

„ prurita,

Cantharospermum pauciflorum.

„ albicans, (Poombary ghât.)

„ ? sp. very long filiform racemes.

Dunbaria, sp. Poombary ghât and Vellaycovay, This sp. I cannot identify with any of Dr. Wight's, the calyx is not herbaceous, nor are the bracts 3 toothed, the vexillum is as much reflexed as in "Kennedya."

Cylista scariosa,

Cyanospermum tomentosum, Poombary valley,

Erythrina Indica,

Butea parviflora,

„ frondosa,

Pongamia glabra,

Dalbergia latifolia,

„ sissoïdes,

„ volubilis,

„ paniculata,

Brachypterum scandens,
Pterocarpus marsupium,
Inga xylocarpa,
Dichrostachys cinerea,
Prosopis spicigera,
Acacia Sundra,
,, latronum,
,, amara,
,, odoratissima,
,, speciosa,
,, Intsia,
,, pennata,
Guilandina Bonduc,
Cœsalpinia mimosoides, Perryur (very common.)
,, sepiaria,
Tamarindus Indica,
Cassia fistula,
,, auriculata,
,, occidentalis,
,, Tora,
,, absus,
,, pumila,
,, obtusa, lower slopes,
Bauhinia Malabarica,
,, racemosa,
,, variegata, (at Vellaycovay.)

ROSACEÆ.

Rubus lasiocarpus, from 3,000 feet.
,, rugosus, from 5,000 feet.
,, gowreephul,
Fragaria elatior,
,, Indica,
Potentilla Leschenaultii,
Rosa involucrata,
Photinia Lindleyana,

SALICARIACEÆ.

Ammania sp.

Lagerstrœmia microcarpa,

COMBRETACEÆ.

Terminalia Catappa,
 „ Belerica,
 „ Chebula,
 „ tomentosa,
 „ paniculata,
Conocarpus latifolius,
Gyrocarpus Jacquini,

MEMECYLACEÆ.

Memecylon sp :

MELASTOMACEÆ.

Sonerila Rheedii ?
Osbeckia Wightii,
 „ Leschenaultii,
 „ hirsutissima,
 „ Zeylanica,

MYRTACEÆ.

Rhodomyrtus tomentosus, Very common, berries eaten.
Syzygium jambolanam,
 „ sp.
Eugenia sp.
Careya arborea,

ONAGRACEÆ.

Jussiæa repens,
Ludwigia parviflora,
Circœa sp. Common in grassy places near the large Kookul shola.

CUCURBITACEÆ.

Coccinea Indica,
Bryonia Garcini, Lower slopes.
 „ laciniosa,
 „ scabrella,
 „ ? Hookeriana,
Momordica charantia,
Trichosanthes ? Diœcious ? Leaves 3-5 lobed, scabrous above, downy beneath, with hard tipped serratures, female flowers racemes with large glandular

laciniate bracts, sometimes solitary, or 2 together in the axils of the leaves with one lanceolate bract, stigma 3-4 cleft, 3 sterile filaments inserted low down in tube of corolla. Male flowers with a large and more laciniate calyx, filaments 3 (rarely 4) quite distinct, inserted on the gibbous upper part of the tube, anthers united, corolla very hairy on the inside, tendrils 2-3 cleft, flowers white. Berry globose.

At Tandigoody and Perryor. (Natchantalle.)

PASSIFLORACEÆ.

Passiflora Leschenaultii,

PORTULACACEÆ.

Trianthema decandrum,

CRASSULACEÆ.

Kalanchoe grandiflora, Flowers used medicinally.

*UMBELLIFERÆ.

Hydrocotyle polycephala,	Sholas (very common.)
Sanicula elata,	,,
Bupleurum ramosissimum,	Abundant in the grass on the higher ranges.
Pastinaca sp.	Do. do. do.
Pimpinella Candolleana,	Do. do. do.

ARALIACEÆ.

Hederá rostrata,	Sholas.
,, racemosa,	do.
,, obovata,	do. very common.

LORANTHACEÆ,

Viscum verruculosum,
,, angulatum,
,, grossum,

---

* *Heraeleum pedatum*, (Wight) may be added, see Icon. t. 342.

Viscum moniliforme,	On "*Rhododendron arboreum,*" *very common*, glabrous, leaves ovate, very obscurely nerved, thick, opposite, racemes axillary or terminal, many flowered, pedicels short, one small bract embracing the calyx. Calyx entire or nearly so, corolla glabrous, ventricose at base, equally 4 cleft to below the middle, segments cuneate linear, berry oblong, flower deep dull orange color.
Loranthus (Symphyanthus) sp: nov.?	
,, loniceroïdes,	at Cowangee.
,, buddleoïdes,	common on the lower ranges.
,, sarcophyllus,	common.
,, amplexifolius,	leaves with a transparent margin.
,, Candolleanus,	at Kodakarnal.
,, cuneatus,	very common.
,, Euphorbiæ,	growing on *Euphorbia antiquorum*, near foot of hills.
,, sp. nov.?	Lower slopes growing on "*Salvadora Indica*" rarely on "*Cordia polygama?*" Glabrous, branches very woody, leaves nearly opposite or approximated in threes, very long, linear, often much curved, of a thick texture, short petioled attenuated at base, obtuse or slightly acute, racemes axillary, or from the axils of fallen off leaves, many flowered, pedicelled, one bract embracing the ovary, calyx entire or nearly so, corolla curved, apex split into 5 segments, one third the length of the tube, segments, linear acute, ovary oblong crowned with calyx, flowers whitish with the segments green.

CAPRIFOLIACEÆ.

Viburnum acuminatum,	common at Poombary.
,, capitellatum,	,, ,,
Lonicera Leschenaultii,	very abundant.

RUBIACEÆ.

Nauclea parviflora,	
Mussænda frondosa,	
Gardenia lucida,	(pissanee) in sholas.
Randia dumetorum,	
,, uliginosa,	
Griffithia fragrans,	slopes towards Verupatchy.
Wendlandia Notoniana,	very common.
Hymenodyction excelsum,	
Hedyotis stylosa,	} higher ranges only.
,, articularis,	}
,, pruinosa,	}
,, monosperma,	}
,, affinis,	} flowers very fetid.
,, Burmanniana,	
,, Heynii,	} these 2 little plants are common in hilly places in Central India.
,, dichotoma,	}
,, aspera,	lower slopes.
Lasianthus venulosa,	sholas Kodakarnal, (berries blue.)
,, sp.	Kookul sholas, (flowers very fetid, berries black.)
Canthium umbellatum,	grows to a good sized tree. (lower Pulnies.)
,, parviflorum,	
Psychotrium ambiguum,	} sholas.
,, sp.	}
Grumilea congesta ?	}
Bigelowia lasiocarpa,	
,, Roxburghiana,	
Spermacoce hispida,	
Knoxia corymbosa,	very abundant.
,, Wightiana,	in the grass near Poombary.

GALIACEÆ.

Rubia cordifolia,	very abundant.
Galium asperifolium,	
„ Requienianum,	

VALERIANACEÆ.

Valeriana Leschenaultii,	Poombary ghat.
„ Hookeriana,	Cowangee hill streams.

DIPSACEÆ.

Dipsacus Leschenaultii,	common.

CAMPANULACEÆ.

Campanula Alphonsii,	common.
„ fulgens,	
Wahlenbergia agrestis,	very common.
„ perotifolia,	

LOBELIACEÆ.

Lobelia trichandra,	a very common plant.
„ trigona,	

PYROLACEÆ.

Pyrola sp.	Kodakarnal.

ERICACEÆ.

Gaultheria Leschenaultii,	(Moorcherree) berries eaten.
Rhododendron arboreum,	very abundant.

VACCINIACEÆ.

Vaccinium Neilgherrense, } Leschenaultii, }	common shrubs.
?	Poombary ghât, axillary spikes of green flowers.

ULMACEÆ.

Celtis orientalis,	from the plains to the highest elevations.

STYRACEÆ.

Symplocos Gardneriana,	sholas.
„ pendula,	Kodakarnal, banks of streams.

EBENACEÆ.

Maba Neilgherrensis,

AQUIFOLIACEÆ.

Monetia tetracantha,

APOCYNACEÆ.

Carissa Carandas,	
Ophioxylon Neilgherrense,	near Puttoor.
Vinca pusilla,	fields.
Wrightia tinctoria,	
Alstonia venenata,	
Ichnocarpus frutescens,	
Echites sp.	slopes near Pulney.

LOGANIACEÆ.

Strychnos nux-vomica,	
Gardnera Wallichiana,	sholas.
Fagræa Coromandeliana,	

ASCLEPIACEÆ.

Hemidesmus Indicus,	
Holostemma Rheedianum,	
Calotropis gigantea,	
Sarcostigma brevispina,	
,, sp.	
Dæmia extensa,	
Cynanchum pauciflorum,	Kookul.
Tylophora mollissima,	common.
,, tenuissima,	sholas.
Hoya viridiflora,	
,, pauciflora,	a rare and beautiful parasite.
Ceropegia intermedia,	
,, acuminata,	
,, tuberosa,	slopes towards Verupatchy.
,, juncea,	lower slopes.
,, elegans,	
,, sp.	Root fibrous, leaves remote, lanceolate, tapering to a long point, slightly hairy, covered with minute dots, racemes cyme like, axillary, 2—6 flowered, flowers very large, greenish, upper part of tube and segments speckled with purple, segments of calyx, very narrow and acute, nearly allied to *C. Decaisneana*, a bulbous plant.

Caralluma?	Stem filiform, with a few narrow linear leaves near the apex, hardly two lines broad, flowers bell shaped, drooping, purple. (Poombary valley.) I unfortunately lost the only specimen that I found of this curious little plant.
Boucerosia diffusa,	on rocks.

OROBANCHACEÆ.

Æginetia pedunculata,	flowers of a most lovely deep blue, parasitic on the roots of a grass.
Oligopholis tubulosa,	Kodakarnal shola.
Campbellia sp.	Tandigoody sholas.

GENTIANACEÆ.

Gentiana verticellata,	
Ophelia elegans,	higher ranges, most abundant in the grass.
,, Griesbachiana,	glands on the petals very hairy.
Halenia Perrottetii,	borders of sholas common.
Exacum tetragonum,	
,, Perrottetii,	abundant near Poombary, a very beatiful species.
,, nov sp.	herbaceous, erect, glabrous, leaves opposite, broadly ovate, stem clasping, 5—7 nerved, suddenly acuminated, 2 bracts about the centre of the peduncles, flowers very large of a deep blue. Poombary and Kodakarnal. (Introduced into gardens at the latter place.)
,, pedunculare,	
Canscora diffusa,	

SOLANACEÆ.

Solanum sp.	Shrubby, erect, leaves petioled, ovate lanceolate, acuminated at both ends,

	stems and every part but the flowers covered with longish weak hairs, flowers axillary 2-3 together, on peduncles a little longer than the petioles, berries small, 6 seeded. In sholas, grows to 12 feet high.
Solanum ferox,	higher ranges common.
,, giganteum,	do. do. do.
,, Indicum,	
,, rubrum,	
,, pubescens,	Lower slopes (flowers purplish.)
Datura fastuosa,	
Physalis minima,	
,, Peruviana?	The Brazil cherry (so called,) is wild all over the hills; it has I suppose been introduced.

OLEACEÆ.

Olea robusta,	Bits of the bark are thrown into the toddy extracted from *Caryota urens*, to cause fermentation.

CORDIACEÆ.

Cordia myxa,	Lower slopes.
,, polygama?	,, ,, near Chattrapatty.

*CONVOLVULACEÆ.

Evolvulus alsinoides,	
Porana racemosa,	a rare plant, slopes near Cowangee.
Convolvulus rufescens,	common on the higher ranges, 6 to 7,000 feet.
Calonyction speciosum,	valleys and slopes.
Ipomea Wightii, (I have since found this sp. on the plains at Anamallay.)	common at Puttoor and Poombary; flowers very large, (the calyx and the leaves are much like those of I. pilosa,) 6 to 7,000 feet.

* Of these only 3, viz. *Ipomea Wightii*, *I. nov. sp?*, and *Convolvulus rufescens* inhabit the higher elevations.

Ipomea pilosa,		on the slopes of the hills and in valleys.
,, hispida,		
,, dentata,		
,, striata,		
,, staphylina,	an enormous climber.	
,, pes tigridis,		
,, pileata,		
,, tuberculata,		
,, obscura,		
,, ? nov. sp : ?	Procumbent, stems, leaves and calyx strigose, leaves alternate, distant, narrow, cordate, flowers axillary, solitary, short peduncled, calyx with the 3 outer sepals, ovate, the 2 inner linear, and longer than the outer ones, 2 bracts below the calyx, capsule——, flowers lilac, rather large; in the grass near Puttoor, 6,000 feet.	
Hewittia bicolor,	Slopes.	
Pharbitis nil,	Lower Pulnies.	
Rivea cuneata,	do. do.	
,, bona nox,	Slopes.	
Argyreia aggregata,	,,	
pomacea,	,,	
hirsuta ?	,,	
Aniseia uniflora,	Alpine vallies 3,000 feet.	

PLUMBAGINACEÆ.

Plumbago Zeylanica,

PRIMULACEÆ.

Lysimachia Leschenaultii,	(very common.)
Anagallis latifolia,	(fields.)
Micropyxis tenella,	(Kodakornal.)

MYRSINACEÆ.

Mæsa Indica,	very common in Sholas.
Embelia Tsjeriam-cottam,	at Vilputty and Perryur.
Myrsine capitellata,	in sholas, common.

Ardisia humilis,	sholas.
" pauciflora ?	sholas at Kookul.

Jasminaceæ.

Jasminum revolutum,	higher ranges, all common.
" brevilobum,	"
" rigidum,	"
" sp.	lower slopes.

Salvadoraceæ.

Salvadora Indica,	lower slopes.

Ehretiaceæ.

Ehretia aspera,	Pautcheloor slopes.
" sp.	" "
Heliotropium Rottleri,	lower slopes.

Boraginaceæ.

Trichodesma Zeylanica,	lower slopes.
Cynoglossum furcatum,	higher ranges.

Lamiaceæ.

Ocimum sp.	
Orthosiphon sp.	
Plectranthus Wightii,	common.
" sp.	(obovate bracts.)
" sp.	
Coleus barbatus,	very common.
" spicatus,	at Perryur.
Anisochilus albidus,	
" purpureus,	
" sp.	on rocks, with silvery leaves.
" sp.	a large shrub, with cordate serrate leaves, very common.
Pogostemon rotundatum,	
" sp.	
" sp.	
Dysophylla auricularia,	
Micromeria biflora,	higher ranges, common.
Melissa umbrosa,	sholas, common.
Prunella vulgaris,	at Poombary.

Scutellaria violacea,	very common.
,, sp.	
Leucas ternifolia,	Common in the grass on the higher ranges.
,, biflora,	
,, cephalotes,	
,, sp.	Lanceolate serrate leaves, dense capitate or axillary heads of flowers, whole plant densely covered with deflexed brown hairs.
Leonotis nepetæfolia,	
Teucrium tomentosum,	

VERBENACEÆ.

Stachytarpheta sp.	Slopes near Pulney, most abundant, flowers blue,
,, sp.	common near Perryur, a handsome plant with lilac flowers, not unlike *S. mutabilis.*
Bouchea ?	Lower slopes.
Lantana Indica,	Very common,
Vitex negundo,	Perryur, flowers used to ferment a beer that the natives make from the Ragee.
,, alata,	
Premna Wightiana,	Slopes near Verupatchy.
,, cordifolia,	
,, tomentosa,	
Tectona grandis,	Lower slopes.
Gmelina arborea,	Wood much valued by the natives, Peryur.
Clerodendron infortunatum,	Sholas.
,, serratum,	a very common plant.
Callicarpa Wallichiana,	Sholas.

PEDALIACEÆ.

Pedalium murex,	Lower slopes.

GESNERACEÆ.

Klugia sp,	(Lower lip of corol 3 lobed.)

Æschynanthus Ceylanica,	A beautiful and rare parasite, the leaves are those of a Hoya.
Didymocarpus tomentosus,	Very common, 500 feet up to 6000.

BIGNONIACEÆ.

Stereospermum sp.	There is a tree of this sp. in the Madras Horticultural Garden, it does not appear to be described.
Bignonia xylocarpa,	

ACANTHACEÆ.

Thunbergia fragrans,	Very common.
Dyschoriste littoralis,	(Lower slopes.)
Dipteracanthus patulus,	,, ,,
Phlebophyllum Kunthianum,	Very common in the grass on the higher ranges.
Stenosiphonium Rusellianum,	near Kodakarnal.
Strobilanthes micranthus,	Poombary in hedges.
Asystasia Coromandeliana,	
,, sp. apparently the same as the above.	with bright yellow flowers.
Barleria buxifolia,	Lower slopes.
,, cuspidata,	,, ,,
,, sp.	,, ,,
,, prionitis,	,, ,,
,, sp.	a very large shrub 15 to 20 feet high, with ovate lanceolate, acuminate leaves, perfectly covered with very large blue flowers; a very handsome sp. Poombary ghât, sholas near Vilputty.
Blepharis Madraspatensis,	
Crossandra infundibuliformis,	very common.
Endopogon ? ?	This like "Endopogon strobilanthes" has the corolla of Endopogon but has 4 stamens; shrubby, leaves

	opposite, ovate, serrate, generally very unequal in size,long petioled, minutely dotted and covered with a harsh pubesccnee, flowers from axillary peduncled capitate heads, surrounded by broad hairy bracts, flowers pale blue. Kookul, common in hedges close to the village.
Hemigraphis latebrosa,	
Rostellularia procumbens,	borders of sholas.
,, sp.	
Eranthemum montanum,	
Adhatoda Vasica,	
,, betonica,	
Rhinacanthus communis,	
Rungia pectinata,	
,, ?	a shrub in Kodakarnal shola.
Rhaphidospora glaber,	lower slopes.
Andrographis Wightiana,	in sholas.
,, Neesiana,	do.
,, paniculata,	
,, viscosula,	in sholas.
Leptacanthus ?	in sholas below Kookul ghât.

SCROPHULARIACEÆ.

Verbascum ?	a pretty yellow flowered annual, common in the grass on the higher ranges.
Limnophila sp.	
Torenia Asiatica,	moist places, very common.
Vandellia crustacea,	
Bonnaya sp.	fields near Vilputty.
Buddlea discolor,	
Striga densiflora,	
,, ? orobanchioides,?	yellow flowers.
Gerardia delphinifolia,	very common.
Pedicularis Zeylanica,	most abundant on the higher ranges.

UTRICULARIACEÆ.

Utricularia Wallichiana,
,, humilis,
,, racemosa,

NYCTAGINACEÆ.

Boerhaavia procumbens,
,, humilis,
Pisonia aculeata, lower slopes.

AMARANTACEÆ.

Achyranthes aspera,
,, sp.
Euxolus caudatus, lower slopes near Pulney.
Psilotrichum nudum, ,, ,, ,,
Ærua floribunda,
Amaranthus frumentaceus, (A flour is made from the seed.
Celosia pulchella,
,, argentea,

CHENOPODIACEÆ.

Chenopodium ambrosioides, An abundant weed about Perryur.

POLYGONACEÆ.

Polygonum Nepalense, Kookul in fields.
,, Chinense, Very common, used medicinally.
Rumex Nepalense, Kookul.

BEGONIACEÆ.

Begonia dipetala, Abundant.

LAURACEÆ.

Cinnamomum iners, Sholas very common.
Alseodaphne semicarpifolia, Sholas.
Cylicodaphne Wightiana,
Tetranthera tomentosa,
and 3 other trees of this order.

MYRISTICACEÆ.

Myristica sp. (Palmanee kam.)
,, tomentosa? the mace round the nut is used by the natives to color their teeth.

ELEAGNACEÆ.

Elæagnus latifolius, very common, the berries are eaten.

THYMELACEÆ.

Gnidia eriocephala, grows to a tree in the Kookul shola, much used by the natives as a fibre, and called Kàt murke nàr.

SANTALACEÆ.

Thesium Wightianum, near Kodakarnal.

Osyris Wightiana, the bark is eaten like suparee with chunam, it turns the saliva red, a common shrub.

Santalum album, near Pullatoor.

ARISTOLOCHIACEÆ.

Aristolochia Indica,

" acuminata,

EUPHORBIACEÆ.

Euphorbia Rothiana,

" trigona,

" antiquorum,

" tirucalli,

" Nivulia,

} lower slopes.

Dalechampia velutina, common near Perryur.

Tragia involucrata,

" sp. densely covered with reddish hairs, (at Poombary common.)

Acalypha Indica,

" ? a shrub, slopes towards Verupatchy.

Macaranga Indica,

Claoxylon sp.

Arboreous, diæcious, leaves opposite, oblong, lanceolate, attenuated at both ends, serrate towards apex, glabrous—below covered with resinous dots, spikes axillary, male flowers glomerate, (not amentaceous), spikes about the length of leaves—styles 3, capsule tricoccous muricated.

Givotia Rottleriformis,	very common.
Ricinus communis,	
Rottlera peltata,	a common tree.
,, tinctoria,	
Baliospermum polyandrum,	
Briedelia spinosa?	lower slopes.
,, sp.	do.
Cluytia collina,	
Phyllanthus, 2 species,	
Melanthesa turbinata,	
Emblica officinalis,	very common.
Glochidion?	Perryur—a large shrub, opposite, lanceolate, shining, serrate leaves, dense amentaceous axillary spikes.
Sarcococca trinervia,	very common on the higher ranges.
Rèidia floribunda,	common about Tandigoody, a showy plant.
Macrœa Rheedii?	leaves and stems covered with a few silvery hairs, especially below, margins ciliated.
,, sp.	shrubby, erect, stems angled, glabrous, leaves nearly sessile, oval, whitish below, margins revolute—female pedicels half the length of the leaves.

URTICACEÆ.

Urtica vesicaria,	sholas at Tandigoody.
Laportea terminalis,	a severely stinging plant.
Girardinia Leschenaultiana,	stings severely. Flowers used medicinally, very common.
Elatostema cuspidata,	abundant.
Pilea trinervia,	
,, sp.	
Splitgerbera?	with very large caducous stipules.
Pouzolzia, 3 species,	

CANNABINACEÆ.

Cannabis sativa,

MORACEÆ.

Dorstenia Indica,	at Tandigoody.
Covellia ? (Ficus),	an enormous climber.
Ficus, 8 or 9 sp.	all trees.

ARTOCARPACEÆ.

Artocarpus integrifolia,	abundant in sholas on the lower ranges.
Conocephalus niveus,	common, lower range.
Trophis aspera,	lower slopes, common.

ANTIDESMEACEÆ.

Antidesma paniculata,

PIPERACEÆ.

Peperomia Wightiana,	very common.
,, Dindigulensis,	
,, reflexa,	
Piper attenuatum,	
,, Wightii,	

CHLORANTHACEÆ.

Sarcandra chloranthoides,

DIOSCOREACEÆ.

Dioscorea tomentosa,	
,, pentaphylla,	roots eaten.
,, sp.	

SMILACEÆ.

Smilax Zeylanica,	sholas near Cowangee.
,, maculata,	very common, a polymorphous species.

CYCADACEÆ.

Cycas circinalis,

ORCHIDACEÆ.

Liparis olivacea,	on rocks.
,, atropurpurea,	
Oberonia Arnottiana,	
,, verticillata,	
,, sp.	a minute sp. Permaulmallay (on trees) 8000 feet.

Microstylis Rheedii,	
,, versicolor,	
Dendrobium filiforme,	on trees in sholas on the Permaul-mallay.
Cœlogyne corrugata,	on rocks near Vilputty. (A most beautiful plant.)
Pholidota imbricata,	
Ania latifolia,	
Eulophia ramentacea,	rare, slopes between Kodakarnal and Velaycovay.
Vanda Roxburghii,	lower slopes.
Saccolabium guttatum,	
,, Wightianum,	at Poombary.
Ærides Lindleyana,	on rocks near Tandigoody.
Sarcanthus filiformis,	
Cymbidium aloifolium,	
Polystachya luteola,	
Calanthe Perrottetii,	very common in sholas. (A most beautiful species.)
Satyrium sp.	very abundant all over the higher ranges, flowers a lively pink.
Platanthera Susannæ,	at Kookul and Shambaganoor, very common in the grass.
,, lutea,	similar places to the last.
,, iantha,	Kookul ghât, a rare plant rather.
,, affinis,	near Kookul.
Peristylus exilis,	
Habenaria peristyloides,	
,, elliptica,	
,, plantaginea,	
,, longicalcarata,	the commonest Orchid on the hills.
,, montana,	common.
,, Lindleyana,	
Ate virens,	
Josephia latifolia,	
Spiranthes Australis,	apparently more than one species, in grass near Kodakarnal.

XYRIDACEÆ.

Xyris Indica,

COMMELYNACEÆ.

Commelyna polyspatha,
,, Bengalensis,
Dictyospermum protensum, in sholas,
Aneilema paniculata,
Cyanotis cristata,
,, pilosa,

JUNCACEÆ.

Juncus sp.
,, sp.

MELANTHACEÆ.

Disporum sp.
Gloriosa superba,

LILIACEÆ.

Lilium Wallichianum,	very abundant higher ranges.
Sanseviera Zeylanica,	lower slopes.
Anthericum tuberosum,	
Asparagus racemosus,	
Phalangium sp.	
Ophiopogon Indicus,	
Peliosanthes sp.	

PONTEDERACEÆ.

Pontederia vaginalis,

ZINGIBERACEÆ.

Zingiber squarrosum,	
Curcuma montana,	
Elettaria Cardamomum,	much cultivated.
Hedychium coronarium,	banks of streams abundant.
,, ,,	variety with straw colored flowers.
Costus speciosus,	

MARANTACEÆ.

Canna sp. Sholas at Tandigoody.

AMARYLLIDACEÆ.

Crinum sp.

HYPOXIDACEÆ.

Curculigo orchioïdes,
,, sp.

ARACEÆ.

Arum sp.	Poombary well,
,, sp.	Sholas near Kodakarnal.

PANDANACEÆ.

Pandanus odoratissimus,

PALMACEÆ.

Areca,	(Kát pān.)
Caryota urens,	Lower ranges, a fibre is made from the peduncle.
Borassus flabelliformis,	about villages, lower ranges.
Bentinckia condapana,	Sholas.
Phœnix sp.	
Cocos nucifera,	rare about villages.

EQUISETACEÆ.

Equisetum sp.	Poombary valley.

GRAMINACEÆ AND CYPERACEÆ.

Are both abundantly represented on these hills.

BRYACEÆ.

This order is abundant.

LYCOPODIACEÆ.

Five or six species,

OPHIOGLOSSACEÆ.

Several species,

POLYPODIACEÆ.

Between 40 and 50 sp. all I believe Neilgherry forms.

I have not attempted to name the Compositæ, in the above catalogue, there are many of the larger Neilgherry forms.

The above is not supposed to include nearly all the flora of the sholas (or moist woods) of the higher ranges, especially the trees, few of which were in flower at the period of my visit to these mountains.

XII. *Notes of an excursion along the Travancore Backwater.* *By* CAPTAIN HEBER DRURY, 45*th N. I.*

During a recent trip by water from Trevandrum to Cochin, it struck me that a few notes descriptive of what may be seen in the course of a hundred and thirty miles of the Western Coast might not be altogether devoid of interest. The country I am about to describe lies within the kingdom of Tranvancore, the southernmost portion of Malayala, formerly known as the kingdom of Kerala, which comprised what is now designated Malabar and Canara, including the principalities of Travancore and Cochin. Travancore may be said to commence at Cape Comorin, and to include a narrow slip of territory lying between the Ghauts and the sea extending to within 20 miles of the town of Cochin, the total length being about 175 miles, and the breadth varying from 25 to 70 miles. The farthest distance, viz., from Cochin to a mountainous peak on the east boundary has been calculated at 75 miles, averaging about 35 miles throughout the entire distance, the total area comprising from 600 to 700 square miles, and within these limits is a country diversified by scenery of the most unparalleled beauty, rich and teeming with the products of nature. The high mountain land which forms its eastern boundary is covered with dense forests, while the periodical rains which render the soil so fertile, cause the most profuse vegetation to spring up, giving a charming appearance of freshness and verdure unknown to the inhabitants of the eastern coast.

As it is not my purpose to write a description of Travancore, I proceed at once to record such features or incidents as I noted in the journey recently undertaken. There are two routes on leaving Trevandrum for the north, one by the road, and the other by the canal. I chose the former, for the canal is long, tedious and uninteresting, whereas by land the distance is only eleven miles to Cunneapooram, where you at once reach the open backwater. The road is through a fine semi-cleared jungle, rich in Botanical products, and though not thickly populated, a few villages occur at distant intervals, the largest of which are Ooloor and Wulleecotum. To a person arriving from the Coromandel Coast, the aspect of a vil-

lage in this part of the country cannot fail to excite surprise and interest, awakening associations of comfort and cleanliness, if not of a superior stage of civilisation, to which the tree-less and half-deserted villages on the other side of the Ghauts present a sad contrast. The great ambition of the Travancoreans, even of the lowest class, is to possess a garden, wherein they can grow with scarcely any trouble or expense, the few necessaries of existence. Nature too flings her stores with such a liberal hand that little care is requisite in rearing the vegetable products which these people live upon. Hence it is that a Travancorean village is a series of huts, enclosed in gardens wearing an eternal verdure fresh and cheerful to the eye. The peculiar trees which succeed so well in this moist climate, combine to render the Nair cottages and gardens most picturesque and comfortable. In one small enclosure may be seen grouped together the graceful Areca Palm (*Areca Catechu*,) the Jack tree (*Artocarpus integrifolius*,) with the Pepper vine (*Piper Nigrum*) climbing up its bark. The Sago Palm (*Caryota urens*), the Talipot Palm (*Corypha umbraculifera*), besides the Cocoa palm, Plantain, Tamarind and Mango trees, &c. These gardens are protected by mud walls or hedges of different heights, and are traversed by little lanes and bye ways. That such too has been the custom for centuries, may be known from an ancient* book in my possession whose author describes them much as they are in the present day. Of the Nairs he records. " They inhabite no Towns, but dwell in houses made of earth invironed with hedges and woods, and their waies as intricate as into a laborinth." These Nairs—the principal inhabitants of Travancore—have, I am inclined to think, degenerated from that martial valour for which their ancestors were once so renowned. Lightly clad, and with a remarkable fairness of complexion, they appear to partake more of an effeminate disposition than that described by earlier writers. It is a known fact that a Nair cannot, as a rule, bear transplantation from his native soil. In a foreign country he pines away and dies; yet in former days the habits of the Nair were peculiarly military and he was trained to hardship and the exercise of war from his earliest youth. The above quoted author remarks on this point.

* Johnson's Relations of the most Famous Kingdom in the World. 4to. 1611.

" It is strange to see how ready the Souldiour of this country is at his weapons: they are all gentile men and tearmed Naires. At seven years of age they are put to school to learn the use of their weapons, where, to make them nimble and active, their sinnewes and joints are stretched by skilful fellows, and annointed with the oyle Sesamus: by this annointing they become so light and nimble that they will winde and turn their bodies as if they had no bones, casting them forward, backward, high, and low even to the astonishment of the beholders. Their continual delight is in their weapon perswading themselves that no nation goeth beyond them in skill and dexterity." This description would be more applicable to a Parthian horseman or Roman Athlete than to the mild and delicate looking Nair of the present day.

But the most peculiar feature in the domestic life of the Nair is in the institution of marriage, and the customs which result from his mode of observing this ceremony, so different from nearly all other nations of the world. The ceremony of marriage (the term is a complete misnomer,) is performed at an early age by one of the near male relations of the family, usually by a cousin. When the forms attendant upon this nominal union have taken place, all communication between the youthful pair ceases, and the girl returns to her relations. On arriving at or near the age of *maturity*, a more real ceremony is performed, when another husband pressents himself, and this couple now become man and wife; but should the husband after a certain period not be pleased with the lady of his choice, he has the option of returning her to her parents or relatives, when both are at liberty to seek a fresh union in other quarters. No disgrace is attached to this proceeding, nor is the summary divorce and violent disruption of the marriage tie in any way illegal. There is in point of fact, no actual marriage such as we understand the sacred institution, and it is in consequence of a custom so abhorrent to our feelings of propriety, and one so subversive of everything which should create and strengthen the ties and relationship of domestic life, that in cases of heirdom either to the throne of the royal family, or the succession to property, the descent is recognised only in the female line. The nephew, not the son, becomes the heir. Truly the remark which Telemachus makes

to Minerva is most worthily appropriate to the Nair race.* From so strange a custom the moral tone of the inhabitants may be better conceived than† described. The same practice obtains, I believe in Nepaul.

Returning from this digression on the Nair race, I come again to speak of the road I was traversing and which I remarked was one full of treasures for the botanical collector. It is a garden of wild plants the whole way, for scattered on either side are

> ' The living herbs, profusely wild,
> O'er all the deep green earth, beyond the power
> Of Botanist to number up their tribes.'

In enumerating a few of the trees and shrubs, which are met with, perhaps I may convey some idea of the Flora of these parts. Among the most conspicuous trees are many fine specimens of the *Vateria Indica* with its large panicles of white flowers, and bright green leaves whose veins are so prominently marked. It is well known that this tree, (commonly called the Piney Varnish tree,) yields a valuable Dammer resin. The Piney Gum or Indian Copal, as it is sometimes termed, is much used in these parts for varnishing doors and window frames, candles have also been made of a solid oil contained in it. The experimental manufacture which was conducted by Dr. Wight succeeded, but the cost of transmission to England precluded the hope of profit. The Resin flows spontaneously or is procured by making vertical and horizontal incisions in the bark, from which in the course of 12, or 24 hours it exudes very freely. The Natives state there are two varieties of this tree, one growing at the foot of the hills yielding a different colored dammer, but this I suspect is a mistake ; and there is little or no difference in the trees, but that the difference in the color of resin is owing to local causes, probably from the season in which it is procured. It is probable that the ' green' dammer is obtained

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* " Stranger ! I tell thee true ; my mother's voice,
Affirms me his, but, since no mortal knows
His derivation, I affirm it not."

Hom. Odyss I. 216. Cowpers translation.

† For a full detail of this extraordinary custom of the Nairs, see Buchanan's Journey Vol. 2. p. 411, 513.

from the *Vatica Tumbagaia*, a tree which I know from specimens before me, yields a dammer *resin of a beautiful light green colour. Another resin similar to the Piney is yielded by the *Canarium strictum*, a tree very plentiful at the base of these mountains but which has hitherto attracted less notice than it deserves. All the above trees belong to the natural families of Dipterocarps or Terebinths, both peculiar for yielding resin. Another handsome tree with dark green foliage growing here is the *Hebradendron gambogioides*. This and several Garcinias are common in these jungles. A considerable quantity of Gamboge exudes spontaneously in largish tears from the trunk, but the quantity procurable is much increased by incision. The Natives eat the fruit of some of the Garcinias with much relish. The *Embryopteris glutinifera*, or wild Mangosteen is here found. This tree is very like the Mangosteen in appearance, and if introduced in gardens would be very ornamental. The viscid juice which surrounds the seeds is used by carpenters as a useful glue, but the fruit is quite uneatable. The *Ailanthus Malabaricus* is not uncommon. The resin which exudes from the bark is known as Muttee pal, and is said to be a sovereign remedy in dysenteric affections. It has very balsamic properties. The *Calosanthes Indica*, *Macaranga Indica* and *tomentosa* are plentiful. The glutinous fluid which flows from the petioles and branches when broken off exudes from both the above species of Macaranga. The large leaves of *M. tomentosa* are hoary beneath with a soft white down, and are used in the bazars for wrapping spices, and similar articles, for purchasers. *Alstonia scholaris*, *Plumiera acuminata*, *Odina Wodier* and other large trees, are most deserving of mention, while conspicuous among lesser shrubs, is *Gloriosa superba* with its bright orange and yellow flowers so curiously arranged creeping from bush to bush, decidedly the most gorgeous of Indian creepers. The root is said to be poisonous. The *Memecylon amplexicaule* is a tropical shrub, which when its flowering stem of deep blue florets is in full blossom, cannot be sufficiently admired. The *Mussœnda frondosa* with its white *calycine* leaf, contrasting so strongly with its orange coloured petals, *Tabernæmontana crispa*,

* For information as to the varieties of Dammer, see Jury Report of Madras Exhibition.—ED.

Dodonæa angustifolia, and *Connarus monocarpus* are also in abundance here. This latter shrub has flowers of exquisite fragrance, and is constantly in blossom The black seed is surrounded by a yellow pulpy aril which is used by the Natives in the following cases. There is a kind of worm which attacks their feet when bathing in tanks or walking in muddy places and by the application of the aril of this seed the worm is either destroyed or expelled. A pretty flowering shrub along the road side is the *Osbeckia aspera* and a smaller species the *O. virgata. Carissas* are very frequent, the *Holostemma Rheedii*, a charming creeper may occasionally may be met with. It is the *Adakodien* of the Hortus Malabaricus. As a creeper for trellis work few *Asclepiads* could vie with its elegant flowers in beauty, *Asystasia Coromandeliana*, (a variety with yellow flowers like our English Primrose,) and a beautiful epiphyte the *Vanda spathulata* of a deeper yellow still are common. But I have no space to enumerate all the beauties of Floras that might be gathered in a ramble through these jungles. Among others may be found *Litsea Zeylanica*, *Careya arborea*, *Syzygium Zeylanicum*, *Ixora coccinea*, *Vitis lanata*, *Gratiola monniera*, *Cyanotis axillaris*, *Bryophyllum calycinum*, *Morinda exserta*, *Callicarpa lanata*, *Smilax ovalifolia*, &c., &c. On reaching Cunneapooram, there is great abundance of the *Calophyllum spurium*, which tree is easily recognised by its young leaves being of a reddish brown hue, giving a singular appearance to the forests at the season of the year when they begin to sprout. At this time (October) the tree is in full flower.

At Cunneapooram the back-water commences. Here a hybrid kind of boat for the reception of the Palankeen was in readiness. This is called a Jangadum, and consists of two canoes lashed together with a platform over them. Upon this latter flooring the palkee is placed, and the whole is urged lazily through the water, two rowers and two men with long bamboo poles. The water here is rather wide in some places—but not deep. The banks are lined with the Cocoa palm and low brush-wood. There is no object of interest until you come to the town or rather village of Anjengo, formerly a place of some note in our early commercial relations with these parts, but now a desolute and almost deserted spot. Anjengo, a corruption of two Tamil words " Unjee Tenkal" the

five Cocoa trees. The remains of the Fort are close to the water edge, now filled with rubbish and jungle.

At Anjengo was for many years an English factory. It rose into importance upon the decline of Quilon, and was one of the last retained by us on this Coast. The Portuguese were the earliest possessors of the spot and the ruins of their Church still exist.* In its palmiest days Anjengo must have been a lively place. "The fortress," says Forbes, "contained store houses, accommodation for the garrison and apartments for the chief who was a member of council at Bombay. The civilians and military officers resided in tolerable houses &c." At the present day a few scattered houses tenanted by East Indians and Natives are all that remain of this once gay and merry station. The place still belongs to the East India Company, and is now chiefly famous for the manufacture in painted wood of the different castes of the inhabitants of the country. These are creditably executed, a male and female of each sect, about 3 or 4 inches in height, draped and ornamented, and on the whole faithful representations. A complete set costs about 40 or 45 Rupees. Great quantities of Lemon grass oil are manufactured at this place. The oil is distilled from the leaves of the *Andropogon citratum*, common in the country. As a remedy for rheumatism this oil is much valued. An East Indian located here is a fair Taxidermist, and keeps a collection of stuffed birds and animals for sale. Of the latter may be chiefly procured the wild Cat, (*Felis Chaus*,) Civet, (*Viverra Zibetha*,) Mongoose (*Ichneumon mungos*,) Flying squirrel, (*Sciuroptera oral*,) Malabar squirrel (*Sciurus maximus*) &c., and among the rest that curious fish the Sea horse (*Hippocampus*,) which is caught in great numbers on the Coast.

One or two celebrated characters have claimed Anjengo as their birth place. Robert Orme, the Historian of Hindostan, first saw light in this remote spot. He was educated at Harrow School, became a member of Council at Madras, and died in England at the advanced age of 73 years. It was at Anjengo that was born Mrs. Elizabeth Draper, an East Indian, the wife of one of the Councillors of Surat, and the lady to whom Sterne addressed the well known "letters to Eliza." I have heard of people stopping at Anjengo to

* Forbes' Oriental Memoirs.

visit Eliza's tomb, under the idea that the defunct lady reposes in the spot of her birth, but alas for the disappointed pilgrim, Eliza enjoys a marble monument in a church in Bristol, far from the land of her nativity.

A few miles beyond Anjengo the water communication ceases. A strip of elevated land about six miles in breadth runs out to the Coast, ending in an abrupt cliff of laterite about 250 feet in height. Travellers land at a small village called Coletotum, where bearers are in readiness to carry them to the opposite side where the back-water is again reached. The road used is partly the sea beach itself, and partly the summit of the cliff in land. About a quarter of a mile from Coletotum there is a Bungalow situated on the cliffs built by the Sircar for the accommodation of Travellers and from this spot the view is extremely beautiful. To the Eastward rises the magnificent line of Ghauts, to the South are the windings of the Back-water dotted occasionally with small Islands whose banks are adorned with thick groves of the Cocoa Palm, Mango, Jack tree, and other features of oriental scenery. The whole landscape is peculiarly striking and picturesque. To the west is the sea-board stretching from Quilon on one side to the low cliffs beyond Trevandrum on the other. I have said before that the cliffs here are composed chiefly of laterite and are known as the Verkullay cliffs. Immediately below the laterite formation of the surface are seen a series of various coloured clays and sandstones, and below them again a remarkable deposit of lignite which crops out in horizontal seams of some extent the base being washed by the breakers. This latter deposit extends for many miles along the coast being found at Cannanore, Mangalore, and other places.* It can be applied to no use as a fuel though of vegetable origin. Below the lignite some specimens of fossil limestone have been discovered by General Cullen. In several places, the laterite here assumes many curious forms having all the appearance of fossils, both animal and vegetable. It has not however, yet been proved that laterite is a fossiliferous deposit, and some persons are inclined to think that the result arises from the action of the rains on a clay highly im-

* A notice of this lignite from the pen of the late Capt. Newbold will be found in Vol. xi. p. 239, of this Journal—Ed. M. J.

pregnated with iron, which is perforated by certain minute insects and becomes indurated by exposure to the atmosphere. This is a curious point to be decided by Geologists. But the age, formation and history of the laterite is still a *questio vexata*, and until more light is thrown upon the origin of so extensive a deposit, we must remain in partial ignorance of its contents. A few scattered shrubs are seen on these cliffs. A species of *Barleria* with pretty blue flowers is frequent. It makes an excellent border plant in gardens. The *Pandanus odoratissimus* grows plentifully here also. There appear to me to be two distinct varieties of this shrub. One has a more bushy head, the leaves are darker colored and the spinal processes are disposed at shorter intervals than in the other, which is more open and lax in appearance and the spines are thickly set together. As a plant for binding the banks of canals, &c., it is invaluable. On the right hand side, about midway after leaving the Bungalow lies the village of Paroor, where there is a famous Pagoda and artificial tank. Near this is a mineral spring which deserves to be better known. The water of this spring was formerly brought to Anjengo for sale. It was near Paroor on the banks of the Attengal river, that a former *Rajah of Travancore encamped for ten years in order to dispute the passage of the Rajah of Quilon. His patience was rewarded after so long a delay by the capture of the latter Prince and the annexation of his territories to Travancore. Paroor too was the scene of an action in later times betweeen the British forces and the troops of the Travancore Rajah commanded by the Dewan. A force moved out from Quilon under command of Colonel Chalmers: proceeding to Paroor, he made a successful attempt to dislodge the enemy from their situation. The Nairs though far exceeding in number the handful of British troops opposed to them, fled in confusion leaving several guns behind them. This took place during the troubles in 1809. Two or three miles beyond Paroor, the backwater appears once more in view and boats are in readiness at a place called Eddavah. This was formerly a Danish factory, and the English Governor of Anjengo built a villa there in which he occasionally came to reside. The village now consists of a few shops and fishermen's huts inhabited by Moplahs

* Bartolomeo's Voyage to East Indies.

and Christians. From Eddavah to Quilon the distance is about 12 miles, a journey performed by boats in 3 or 4 hours. There is nothing remarkable in the voyage unless it be several slightly elevated terraces at short intervals which have much the appearance of ancient sea beaches. The uniformity of level is remarkable, and the distance from the present sea line not being great, would perhaps occasion the Geologist no great difficulty in arriving at the history of their origin.

Quilon at present garrisoned by a Corps of Native Infantry, was formerly* a place of some importance. It is variously spelt Collam, Coulam and Coilon, signifying in Tamil 'language ' a tank." It was built, says Bartholomew, in 825 after Christ, and was formerly a city of considerable note. The natives of Malabar begin their era at the period of its foundation saying " so many years after the foundation of Collam." The Portuguese built a large and spacious fortress here, near the modern town of Tangancharey. It is now quite in ruins. Quilon at one time had an independent prince of its own known by the title of the Rajah of Tangancharey. He was subdued and taken prisoner by Vira-Martanda, Rajah of Travancore in 1764, when his territory was annexed to the latter kingdom.

One of the earliest accounts of Quilon is found in the travels of Marco Polo, who lived in the fourteenth century. Discoursing on the several products of this country, he especially alludes to the manufacture of Indigo which he asserts was made here of superior quality and in great quantities. He gives the process of its manufacture as follows. "They procure it from a herbaceous plant which is taken up by the root and put into tubs of water where it is suffered to remain till it rots, when they press out the juice. This again being exposed to the sun and evaporated leaves a kind of paste which is cut into small pieces of the form in which we see

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Marco Polo's Travels, p. 410, Bohn's Ed.

* " About two hundred years ago, the Town was rich, and great and populous; traded to by many *Indians*, enlarged by the Samoryn, and able to number a hundred thousand inhabitants; of such repute it then was for situation, trade, and fidelity of the Cowlamites. But now, the period of her excellency is outrun ; for *Calicut* first, and then *Goa* have not only monopolized but attracted the trade of this as well as other parts thereabouts." Sir Thomas Herbert's Voyage, p. 339, 1677.

it brought to us." This rude process of the early manufacture of Indigo is, as the English Translator has remarked, pretty correct. Indigo to a slight extent is still made at Quilon, though at the present day the place is more famous for its lace manufactory. That it was a place of bustling trade in early time is apparent from the author above mentioned for he says, "Merchants resort thither from various parts of the world such for instance as the kingdom of Mangi and Arabia, attracted by the great profits they obtain both upon the merchandise they import, and upon their returning cargoes. Many of the animals found here are different from those of other parts. There are tigers entirely black, and various birds of the parrot kind, some of them are white as snow, with the feet and back red, others of a diminutive size, &c." The 'black tiger' is the dark spotted cheetah found in the neighbouring jungles."—Bartholomew, who wrote some 3 or 400 years later, alludes to the commercial activity of Quilon. "In this city, there were formerly a great many weaving looms as well as manufactures of cotton and stone ware. Even at present the most ingenious artists reside at Collom. Cotton, pepper, ginger and other kinds of merchandise are carried hither by water, and deposited in ware houses." Probably Anjengo and subsequently Allepey eclipsed Quilon as a commercial emporium.

At one time a considerable force was maintained at Quilon including a European Corps with artillery. The grave yard at Tangencharey is filled with tombs of deceased officers and soldiersof a Queen's Regiment formerly stationed there. During the troubles in 1809, an action was fought here between the British and Travancoreans. This took place under Colonel Chalmers, then commanding the forces. He moved out to meet the enemy, who were approaching from the side of Trevandrum and were commanded by the Dewan in person, amounting to nearly 30,000 men with 18 guns. The engagement which ensued was of short duration. In less than five hours the insurgents were totally defeated losing nearly all their artillery and leaving a large number of slain on the ground. Such was the battle of Quilon.*

* The Nairs were again defeated here in a brilliant engagement by Colonels Picton and Stewart, who dispersed and utterly disorganised the rebel force and captured all their artillery in 1810.

The residency here, built by Col. Munro, is charmingly situated on a slightly rising ground overlooking the back-water. It is a lovely spot, and the park like appearance of the grounds at the back of the house add considerably to its beauty. The garden is spacious and well laid out, the walls skirting the water, and towards the south is a small bay on one side of which is seen the house allotted by the Sircar to the officer commanding the station and immediately opposite the house of John Liddell Esq., both prettily situated at the bank and sourrounded with Casuarinas and other trees.

On leaving Quilon, the scenery of the back-water becomes more romantic and pleasing. Laterite cliffs, about fifty or sixty feet high, rise on either side enclosing little bays with calm and deep blue waters. These cliffs are very picturesque. Small shrubs among which are *Mussænda*, *Ixora*, *Osbeckia*, &c. cover the broken sides and fallen fragments of rock half lying in the water, while the level summits are occupied by gardens, plantations, or small patches of cultivation. Immediately on leaving the Residency, will be seen on the left hand side at the apex of one of these jutting cliffs, a small obelisk enclosed by a group of Casuarinas. This was erected as a tribute of affection by a Captain Gordon to the memory of a favourite dog, which was drowned near the spot. Beyond this on another rising ground is a tiled Bungalow, charmingly situated in a bay known familiarly as Loch Lomond. An officer detached from the Nair Brigade to take charge of the out-posts formerly resided here. It has been unoccupied for many years, though occasionally made use of as a place for picnics and pleasure parties from Quilon. About half a mile beyond this the water opens out into a spacious and beautiful bay. Into this extensive sheet of water pours the Tiruvalla river, and there is an outlet to the sea at its Western extremity known as the bar of Neendacara. The extent of the bay is very considerable, enough to contain half the navy of England, and in fact it is one of the largest harbours in the Peninsula. Unfortunately the water is very shallow which has been the great drawback to its use; what improvements engineering science might accomplish under European superintendence it is impossible to say, but could this noble inlet from the sea

ever be made available for the purpose of ship building the advantages would be incalculable. The river would float down timber direct from the forests, and the possession of a harbour of refuge like this on the Western Coast would be beneficial in the highest degree to the interests of Commerce.

The banks of the water are covered with many interesting plants, and among them will be found *Bruguiera*, *Rhizophora*, *Cerbera Odollam*, *Dilivaria ilicifolia*, *Excoecaria Camettia*, *Scævola Taccada*, *&c.* The latter shrub (Rheede calls it *arbor excelsa*) contains a very acrid caustic juice of which the Natives are greatly afraid. With much difficulty I persuaded them to collect a small quantity. If the juice gets into the eyes the pain would be intense, perhaps causing loss of sight. Other trees* found here are *Alstonia scholaris*, *Calosanthes Indica*, *Terminalia catappa*, *Ailanthus Malabaricus*, while in the low lands and paddy fields *Sphœranthus hirtus*, *Utriculariæ*, *Sphœnoclea Zeylanica*, and *Asteracantha longifolia* are common two or three miles beyond Quilon, the scenery becomes more tame and monotonous, the passage being sometimes through canals occasionally expanding into broad sheets of water. The sea beach at times is very near, the sandy hillocks peeping out here and there between the strips of jungle, or Cocoa palms and fishing villages. The sands are partly covered with *Ipomœa pes-capræ*, *Spinifex squarrosus* and *Dactylon lagopoides*. The singular Mangrove tribe is common along the backwater. It is curious to remark the wonderful provision of nature displayed in this family of plants for the preser-

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* The Revd. E. Johnston lately furnished us with a list of Orchids found by him in the Travancore Forests, which appropriately finds a place here.—ED. M. J.

Pholidota imbricata,
Eria pauciflora,
Cœlogyne corrugata,
Dendrobium filiforme,
——— *macrostachyum,*
——— *ramosissimum,*
——— *barbatulum,*
Bolbophyllum tremulum,
——— *Neilgherrense,*
Lichenora ———,
Arundina bambusifolia,
Vanda spathulata,
——— *Roxburghii,*
——— *Wighiiana,*
Saccolabium Wightianum,
——— *guttatum.*
——— *papillosum,*
Saccolabium rubrum,
Cottonia macrostachys,
Ærides Lindleyana,
——— *Wightiana,*
Sarcanthus pauciflorus,
Polystachya purpurea,
Cymbidium aloifolium,
——— *triste,*
Geodorum dilatatum,
Eulophia virens,
Josephia lanceolata,
——— *latifolia,*
Habenaria Jerdoniana,
Podochilus Malabaricus,
and others not determined.

vation of the species. Take for example the *Kandelia Rheedii* and see the long pendulous roots hanging from the boughs, perhaps the only instance of the kind where the seeds actually begin to germinate before falling from the parent branch. When of sufficient length, should they not reach the water, they drop off, and sink by their own weight in the soft muddy bottom, from whence the new plant springs up. Now were the seeds to drop off at once when ripe, as in other plants, the stream would naturally carry them away, but by this wise yet simple adaptation of means to an end, the plants have the power of increasing to an indefinite extent, in situations where their utility is required and appreciated. The mangrove tribe has an extensive range being found in all tropical countries in salt marshy places, along the shore of the sea.

About twenty miles from Quilon to the left hand is the village of Porcaad, the Dutch had a factory here, and it was formerly a very populous place, but its importance as a pepper depôt decreased on the rise of Allepey. Some miles beyond Porcaad, and within twelve miles of Allepey, on the right hand side at a place called Ambalapuley, the traveller will remark a curious stone image the size of life, standing half out of the water, and apparently in a running attitude. It has a singular appearance. I could never ascertain anything beyond its legendary history, for stories tell that it is the image of a murderer whose victim was a woman he had slain in the vicinity. After the commission of the foul deed, he attempted to escape by running through the water to the opposite side, but the hand of avenging justice turned him into stone on the spot, where he has remained ever since. The image of a man apparently in the act of running is very remarkable. Formerly the boatmen when passing by the haunted locality used to cross themselves and mutter the name of their patron Saint Anthony as they quickly glided by the image of the murderer.

Proceeding along from Ambulapuley there are extensive rice-fields on either side, as might naturally be expected in a tract of country so flat and so abundant in water. The physical configu-

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The Mangrove tribe are most numerous at the Equator, as in Sumatra. Helfer collected 17 species in the Tenasserim Provinces.—ED. M. J.

ration of Travancore is not favourable to the production of large quantities of rice except in certain parts. Patches of cultivation in the hollows between the undulating hills are met with far amid the interior forests to the very base of the hills, but it is only in level tracts like those near Allepey, and the Southern district of Graneel and Calcaud that very extensive sheets of rice cultivation occur. The rest of Travancore, in spite of its natural capabilities, is still allowed to remain desert and uncultivated. Why are all these fine lands permitted to exist in their primitive barrenness? With a noble water communication from one end of the country to the other, with creeks and rivers pouring into this inland sea from every side, yet no effort is made to take advantage of such admirable facilities for the development of the natural resources of the country. British enterprise is not wanting for the undertaking under favorable circumstances, but until sufficient protection is ensured to the speculator by the Native Government, Travancore must remain a sealed country in regard to trade and improvement, when it may be hoped that a happier era will dawn upon the people. General Cullen has proved by the successful establishment of gardens at different elevations, (Vailey Makay and elsewhere,) how well the cultivation of such products as the following prosper, viz., Potatoes, wheat, coffee, sugar, nutmegs, cloves, cocoa &c., all of which thrive and yield abundant produce.

Allepey, Aulopolay, or Alapushe, as it has been variously named, is the present commercial port of Travancore, and the principal depot for salt, Cardamoms, Pepper, Teak-wood and other products of the country. It is reached by a canal leading from the backwater nearly due west, the length being about three miles. This canal is entirely artificial, and is crossed by several bridges, facilitating trade and communication to and from the northern and southern sides. Previous to entering the canal there is a very deep basin, some 40 or 50 feet in depth, inhabited by alligators of of enormous size, which may often be seen basking on the banks, It was in this pool that at the beginning of this century the reigning minister threw such hapless Europeans as chanced to fall into his hands, first sewing them up alive in sacks, and then indulging in the pastime of casting them into the deep waters to

become the prey of the monsters at the bottom. The banks of the canal leading to Allepey are fringed with several interesting plants. The *Lantana Indica*, with its pale pink, orange and white varieties of flowers, is strikingly beautiful. The scarlet festoons of the *Barringtonia acutangula*, and the gorgeous golden spikes of the *Cassia alata* are chiefly conspicuous, large specimens of the *Terminalia Catappa* overhang the banks, while the *Pandanus* so admirably adapted for retaining the soil and preventing its gliding into the water is plentifully planted. The large kind of dock, the *Colocasia nymphæifolia*, with its finely reticulated leaves is thickly growing at the waters edge. Of this latter plant, there are two kinds, to all appearance similar, but one is cultivated for the sake of its roots, which are eaten, while the other is not. The cultivated species is I believe the *Caladium ovatum*, the *Karinfola* of Rheede.

Important as Allepey is to the Travancore Government as a commercial depot, from the facility of an inland water communication, which enables the forest products to be brought to the very doors of the godowns established for their reception, yet undoubtedly its greatest advantage as an emporium arises from the singular natural breakwater formed in the open roadstead, and which consists of a long and wide bank of mud, the effect of which is so completely to break the force of the houses, that large vessels in the stormiest weather can securely anchor in the open roads, where the water is as calm as a mile-pond. It is this extraordinary deposit which has earned for Allepey the name of " mud bay." The origin of this deposition of so large a quantity of mud in the open sea about two or three miles from the shore, and so many miles from any bar or outlet from the backwater has never been satifactorily accounted for. From the circumstance of there being no natural outlet for the vast accumulation of waters which are poured down from the various mountain streams into the basin of the backwater, nearer than thirty six miles on either side, it is not improbable that there exists a subterraneous channel communicating with the sea from the backwater through which the large quantity of mud is carried off and thrown up again by the sea in the form of a bank.

See Captain Coape's Voyage to the East Indies.

Being subject to tidal action the bank is more or less shifting certain seasons but not to a material extent. It imparts a dirty brown colour to the water for a considerable distance, and close to the shore the water is usually of a thickish consistency being deeply impregnated with mud and slime. But whatever may have been the origin of this mud bank, it creates a natural harbour for shipping as secure as any land-locked bay in the world. Allepey is 54 miles from Quilon and 36 miles from Cochin. It is the last place of any importance on the route. After leaving it the backwater opens out into a large and very spacious bay stretching across to the eastward to a distance of ten miles or more. The low coast on the opposite side cannot be seen from the boat's deck, though the ghauts rising in the back ground to the height of 4 or 5,000 feet are clearly visible and form a grand boundary to the landscape. From hence to Cochin the backwater is of varying width, containing small islands, which with the main-land are buried in the everlasting Cocoa palm. Occasionally to the east a clearer view is obtained, and the distant mountain chain and thick jungle at its base afford a striking and beautiful prospect. About mid-way on the right hand side is the town of Vyekkum a place of considerable sanctity. There is a large pagoda here dedicated to Shiva. Vyekkum was a place of refuge to the Brahmins and other Hindoo sects flying from the licentious soldiers of Tippoo when the latter invaded the Cochin territories in 1788-9. On, on, nothing but water and Cocoanuts till at last the Residency at Balghetty embosomed in tufted trees is sighted at a distance, and to the left the shipping in Cochin harbour and the bustling busy town of Cochin itself about two miles away.

Brundisium longæ finis chartæque viæque.

XIII. *Numismatic Gleanings. By* Walter Elliot, *Madras Civil Service.*

No. 1.

Although considerable attention has been paid of late years to the investigation of the Hindu and Mahomedan coins of India, numismatologists have confined their researches chiefly to those occurring north of the Nerbudda and in the trans Indus provinces adjacent the N. West frontier. But whilst the writings of Prinsep, Professor Wilson, Cunningham, Thomas, and others, give ample details of the historical results deducible from the ancient coins which have been discovered in Upper India and Bactria, scarcely any notice has been taken of those of the south.

A principal cause of this neglect is probably to be found in the comparatively uninteresting character of the coins themselves. Although sufficiently numerous and of very diversified types, they rarely present an intelligible legend, and hardly ever a date.

As subjects of historical inquiry therefore, their value is proportionably small. Something however may still be gleaned from them by the patient investigator of past events. The localities and extent of range in which they are found, the variations in the typical symbols of a series, and the occasional occurrence of a name or title, afford data for drawing conclusions, which in the dearth of historical records are far from unimportant.

Southern India presents the extraordinary spectacle of a people who have carried the art of composition to a high degree of cultivation without having produced a single work of a really historical character. The *cheritras, pattiyams, kat'has, van'sávalis, dandakaviles, máhatmyas* which profess to record historical facts are little better than mythological romances, filled with chronological extravagancies and preternatural fables.

The only trustworthy data now extant from which a knowledge of former events can be gathered, are the contemporary records offered by deeds of gift inscribed on stone and copper and by coins. Scattered, obscure and imperfect facts derived from these sources supply almost the whole of the knowledge we possess of the earlier southern dynasties and kingdoms.

It is the object of the following papers to draw attention to the latter of these fields of inquiry and by stimulating a more general and combined investigation of the coins of southern India, to collect and digest the information which may be extracted from them.

A large collection of Hindu and Mahomedan coins was formed by Col. Mackenzie chiefly though not exclusively in the south, which is deposited in the India House Museum. From it duplicates were furnished to the Asiatic Society of Calcutta, but most of these have been lost. The original collection contained upwards of 5,000 specimens, the list of which including a few European coins, occupies from pages ccxxiv. to ccxxxix. of the second volume of Wilson's Catalogue. The Central Museum at Madras contains a pretty good collection derived from the cabinet transferred to it from the Literary Society, greatly enlarged and extended by the present indefatigable Curator. These are the only public cabinets of any extent with which we are acquainted. But several private collections of varying importance are known to exist, the contents of which it is important to ascertain.

The first published notice of coins belonging exclusively to southern India, occurs in Moore's Hindu Pantheon, where, in 1809, the author figured 23 specimens from a small collection procured by Major Price at the prize sale of the contents of Tippoo's treasury, after the capture of Seringapatam. Moore has also described and figured a series of Mysore coins in his narrative of Little's Detachment, p. 465.

In 1832, Prof. Wilson inserted a paper on the coins deposited in the Museum of the Asiatic Society of Bengal, in which he included observations on those received from the Mackenzie collection. This was printed in the XVII. Vol. of the Asiatic Researches and is accompanied by figures of 53 specimens. The descriptions are

extremely short and throw little light on the subject. The specimens of southern coins which fell in the way of James Prinsep were not likely to be overlooked by such a zealous numismatologist. They appear to have been but few and are included in his plate of Ceylon coins published in the Journal of the Asiatic Society in the year 1837.* These together with such other incidental references as have fallen in our way, will be duly noticed in their proper places.

We possess no data to show at what period the use of a coined currency as a medium of exchange was introduced into India. But this we know, that the art of stamping metal with a die for such a purpose, came into Asia from the west. Long previous however to the introduction of a die-coinage, the employment of pieces of metal stamped or punched with various symbols was general throughout India. It is true that a punch or wedge (in French *coigne* whence the modern term *coin*) was also used in the fabrication of the earliest known coins of Europe. But this was always done in conjunction with a die or matrix on which the piece of metal was placed and an impression obtained by means of a smart blow with a hammer on the wedge. One side only of the coin therefore was stamped, the reverse exhibiting the marks of the wedge in the form of one or more square cavities.

The oldest Hindu coins, on the other hand, are distinguished by numerous small indented symbols cut on the punch itself and evidently struck at different times, the later ones often obliterating those which had been previously impressed. And this mode appears to have continued without the introduction of any intermediate process until superseded at once by an improved die-coinage with perfect reverses.

European writers assign the earliest known employment of wedge struck pieces by the Greeks, to the middle of the 7th Century B. C. The piece of metal was generally of a spherical shape which became somewhat flattened after being struck. Of this kind are the *staters* of Melitus, the *drachmas* of Egina called *παχεια* or *thick*,

* Vol. VI. Pl. XX.

the gold and silver *darics*, &c. The use of double dies appears to have been adopted by the Greeks about the 4th Century B. C. The art was transported by the Macedonian conquest into central Asia. From the Bactrian colonies, it passed into Hindustan and appears to have been carried across the Indus about two centuries before the Christian era.

The first known exemplars of such improved coinage are those of the monarchs of the Sah dynasty, whose coins of the size and form of a hemidrachma, are described by Prinsep as the *Surashtra* group. So servile is the imitation that an attempt has even been made to retain an imperfect, and now unintelligible Greek legend on the obverse, whilst the letters on the reverse exhibit an antique form of Dévanágari. But the skill of the die-cutter rapidly deteriorated and the workmanship soon became barbarous, till it assumed a new and purely Hindu type in the coins of the Gupta dynasty. The era assigned to the Sah Kings by the latest authorities is from about 180 or 170, to about 50 B. C.*

The progress of the art towards the south and east was very slow. It did not come into general use south of the Nerbudda until the fifth or sixth century. But this refers rather to the precious metals, for leaden die-struck coins are found in considerable numbers, which appear to date somewhat earlier. Up to the beginning of the present century the money of the trans-Gangetic nations was noting more than lumps of silver, like the *sycee* of the Chinese. China, although so much in advance of all other Asiatic nations in the arts, did not possess a stamped coinage till after the Christian era. Smooth pieces of metal which served rather for weights than for currency, date according to Chinese authorities from Kieng-Wang who reigned B. C. 524, but the earliest known piece with the name of a sovereign is attributed to the Emperor Wen-ti of the lesser Sung dynasty who flourished A. D. 465.†

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* Thomas, Jour. R. As. Soc. Vol. XII. p. 45.

† I. Hager, Description des Medailles Chinoises. The oldest known representatives of value in Eastern countries were shells. The cowry, *cyprea moneta*, even yet serves for purposes of small change in parts of

Of Buddhist coins.

The coins described in this paper are for the most part stamped with emblems peculiar to the worship of Buddha. They have therefore been classed generally as Buddhist coins, and these again have been divided into '*saláka* or punch-coins* and die-coins.

India as well as in Siam, China, Japan, and great part of Africa and the radical character or key in the Chinese words for "silver," "money," "riches," "precious," "expense," &c., is *poei* or "shell." The export of cowries has always formed a principal article of trade from the Maldive Islands and the east coast of Africa. Nails and bars of metal have also been made to serve the same end. Tavernier found pieces of twisted wire called *laris,* [from the province of Lar in Persia] in general use as money, on the Malabar coast. Thunberg saw them likewise in circulation in Ceylon, and Knox describes a similar kind [p. 197,] "which all people by the king's permission, may and do make : the shape is like a fish hook, they stamp what mark or impression on it they please." These seem to resemble the Celtic rings found in Britain and the *oboli* of the Greeks, which were nothing more than *kabob-skewers*— *οβελοι*—a handful of which or about six, made a *drachma* from δϱαττειν "to grasp with the hand."

The knife and tile money of the Chinese, in the form of a scimitar or of a plummet, described by Du Halde [II. 166 and 168 &c.,] and by Hager [pp. 35 and 41,] was of a similar but more elaborate description and the gold *kopang* of Japan, still in use, is simply an oblong plate of gold with the angles rounded off.

In the Manikyala Tope, General Ventura found specimens of shell-money, *i. e.* of the cowry, (J. A. S. B. Vol. III. Pl. XXI. *f.* 17,) together with the spherical flattened ingot (Ib. Pl. XXII. *f.* 25,) Indo-Scythian and Sassanian coins, all of which had been deposited in the mound at the same time. In another tope opened by General Court, Roman *denarii* of Antony and Julius Cæsar and coins of some Roman families were found associated with Indo Scythic pieces of Kadphises.

In Abyssinia pieces of rock salt serve for money. Dr. Barth found stripes of cotton called *farda* and shirts called *dóra* employed for the same purpose in Bornou.

* Jas. Prinsep calls them *ch'háp* or "stamp" coins, *J. A. S. B.* III. 44, Col. Stacy *chungahs,* Ib. p. 433, see too the same Journal I. 394, IV. 621, 629.

The prevalence of the Buddhist faith over the whole of India for two or three centuries before and for a still longer period after the Christian era, sufficiently explains the preference shown to such symbols.

Extensive Buddhist remains can still be traced throughout the Madras Presidency. A principle seat of this sect, appears to have been on the banks of the Kistna in the Northern Circars. The ruins of one of the most magnificent dehgopes ever constructed, can still be traced at Dipaldinni, between the ancient city of D'ha-ranikótah and the more modern town of Amarávati in the Guntoor district. From this were obtained the interesting sculptured marbles now deposited in the Government Central Museum. A very few years ago, a mound or tope was demolished by the Collector to procure materials for the repair of a road at Gudiwádah in the Masulipatam district, from which several curious Buddhist relics were disinterred and two other topes (one of them at B'hattiprolu in Guntoor) still exist in the same part of the country. Several stone vases containing crystal caskets filled with similar remains were discovered by the Zemindar of Pittapoor in digging up the foundations of an ancient temple about the year 1842-3. The articles were sent to the Literary Society by the Zemindar, at the request of Sir Henry Montgomery, then at Rajahmundry, and are now in the Government Central Museum. They were figured in Pl. 2 of the XVth vol. of this Journal, but through some oversight, no description of the plate appears to have been inserted.

Dr. Stevenson has distinctly proved that the great pagoda of Jagannáth at Pooree where the pilgrims eat indiscriminately food prepared by the lowest castes, and where as with the Buddhists, all distinction of caste ceases, was originally a Buddhist temple. The same may be asserted of Conjeveram where the principal place of worship, that dedicated to Kámákshi Dévi was doubtless in the first instance a Buddhist fane. So firmly was the Buddhist religion established in Kalinga (the old name of Telingana) that Asoka thought it unnecessary to issue some of his more stringent edicts in that province.* Nor are similar indications of this creed wanting in the

* Journal Asiatic Society Bengal, Vol. VII. 269.

south. The Buddhist edifice at Negapatam, known as the Puduvól *gopuram*, is well known. Curious Buddhist sculptures have been discovered at Nalliyur and Kalugu or Kazhugu malai in the Tinnevelly district, and many traditions of the destruction of the *Samanar* at Uraiyar near Trichinopoly and in other parts of the country, during a great religious persecution, are still extant.* We may conclude therefore that Buddhism flourished generally and in great splendour throughout the whole of southern India, nor does it seem to have been exterminated until some centuries after the Christian era.

Of the Saláka or Punch coins.

The coins which we have classed under this head, comprize the oldest known descriptions of Indian metallic monies. They are either spherical lumps of metal slightly flattened by the act of striking [Plate VIII. *figs.* 3 to 5]; or thin pieces of irregular shapes, as if cut from a large plate of the size required to meet an occasion or as if trimmed to reduce them when two large, [*figs.* 5½ to 27]. A third description are of a more perfect character, their shape circular, their weight uniform, and the symbols upon them more regulary impressed, [Plate VIII. *figs* 28 to 38]. The transition from these into die coins, [*figs.*31 and 30] is easy and evident.

The symbols impressed on all these descriptions of coins are very various, but for the most part have reference to the Buddhist creed. Others are of a general character such as figures of animals. In no case do they evince a connection with the existing Hindu mythology.† Those on the flat silver pieces appear to have been long in use, the surface of the coin being completely covered with them. Some have been impressed over others of more ancient date partially or wholly obliterating them, and others have been wholly worn out from lapse of time [*fig.* 2.] An ingenious suggestion

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* Ellis in Trans. Madras Literary Society, p. 17; Taylor's Cat. Mackenzie MSS. in Madras Journal Literature and Science.

† In the note attached to the list of this kind of coins in the Mackenzie collection, the *Lingam* is said to have been traced, but in the many specimens we have examined from all parts of India, we have never been able to detect it.—*Wil. Cat.* II, ccxxvii.

to account for the origin of such a practice has been offered by a writer in the Numismatic Journal. "As the act of impressing a seal or signet," he observes, "was an understood sign of solemn compact, from the most early periods, and as engraved seals and signets were undoubtedly in general use long anterior to the invention of coinage, it appears highly probable, that the original idea of impressing a stamp on uncoined lumps of gold and silver was derived from the common application of a seal to wax. The earliest coins may be therefore looked upon as pieces of sealed metal; which in fact they are, it being well known that, at first, coins were impressed only on one side. No device that could be imagined, was so well adapted to the peculiar necessity of the case, or so likely to satisfy the public mind, as the impress, by public authority, of the symbol of the tutelar divinity of their city or of some equally sacred and well known emblem."*

An explanation so obvious can hardly fail of being accepted,—supported as it is by the very general practice still extant in Eastern countries where the custom of hoarding money prevails, of using private stamp-marks. We possess several specimens both from India and China which are covered with such ciphers, the only difference between them and the pieces represented in the plates being, that the marks in the one case are private in the other public. So general is this habit that it is constantly necessary to call in such defaced pieces for recoinage.

The flat silver pieces represented in Plates VII and VIII are found in all parts of India. Those figured were received from Cuddapah, Madura, Coimbatore and Nagpore. In the Mackenzie catalogue they are recorded as having been obtained in Hindustan, about Patna, at Cawnpore, at Hoogly, also at Nellore and generally in the Telugu districts. A large hoard was discovered in September 1807, at the opening of one of the ancient tombs known by the name of *pandu-kúlis* near the village of Chavadi paleiyam in Coimbatore, thus identifying the employment of this kind of money

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* Burgon: Inquiry into the various representations stamped on ancient money. *Num. Jour. vol.* 1.

with the aboriginal race whose places of sepulture are scattered over every part of Southern India. And about four years earlier a pot full of the same pieces was dug up at Pennar, also in the Coimbatore province, among which was found a silver denarius of Augustus, which proves that they were current at the commencement of the Christian æra.

A single example (fig. 5½) of the same kind of money in copper was found among a quantity of Buddhist coins from Oojain. This is the only example we have met with of a true punch coin in baser metal, but smooth and worn pieces of copper of similar shape and appearance are by no means rare.

Description of Plates. The coins figured in Plates VII and VIII represent the oldest descriptions of Hindu money extant.

Figures 1 to 5 are of the simplest kind, spherical, square or oblong pieces of metal with hardly the vestige of a device.

Fig. 1. A silver piece of somewhat peculiar form, from the ancient site near Behat in the Ganga-Jamna Doáb discovered by Captain Cautley in 1834, when excavating the Ganges canal.* It weighs grains 26·85.

Fig. 2. A flat quadrangular piece of copper with merely the trace of a mark, from Mahamallaipúr or the Seven Pagodas. Others of the same shape and appearance are perfectly smooth. The weight differs considerably, the heaviest of six was grains 40·75, the lightest, grains 26·35.

Fig. 3. A spherical ingot of copper very slightly flattened, exhibiting four indistinct indentations: weight grains 31·325.

Fig. 4. A gold piece very similar to the last but having less of the spherical form. It is from the cabinet of Lieutenant H. P. Hawkes, 12th M. N. I. and weighs grains 51·05.

Fig. 5. One of three coins of the same description as Figs. 3 and 4. They were procured in the Soonda division of Canara, and weigh from grains 52·05 to 52.3, the average being 52·2. The indented marks (although) somewhat more elaborate than in the

* Journal Asiatic Society Bengal, Vol. III. pp. 43, 221.

preceding specimens, are too small to allow of their import being recognized.

Figs. 5½ to 27 belong to the second description of punch-coins. They are of various weights ranging from grains 40 to 55. The first only, fig. 5½, is of copper and weighs grains 51·45. The rest are all of silver and their weights as follows :

Figs. 6 and 16	grs. 41.4	Figs. 23	grs. 48.9
9	41.95	17	49.8
24	45.	13 bis	49.85*
13*	45.4	21	50.225
22	46.35	10	50.75
19	47.	26	50.8
18	47.1	11	51.65
25	47.2	7	52.4
15	47.45	12	52.8
27	48.1	8	52.9
20	48.24	10,	54.2

The most common symbols are those of animals. Thus the elephant occurs on figs. 8, 12, 13 (on both sides), 14 (twice), 15, 17, 18, 21, 27.

A dog, always in the same form, with his forelegs half crouching, as if in play, is found on figs. 8, 11, 12, 13, 14, 15, 16, 18, 20, 21, 26.

The figure of a bull is impressed on figs. 17 and 20.

Fish occur in many forms as in figs. 6 and 10, where they appear to be fixed on skewers; in figs. 22 and 23 a fish appears to be associated with a serpent or eel; in figs. 24 and 25 a large fish is in the act of swallowing a small one, and in fig. 24 the fish is pierced with several transverse rods.

The fish has always been a celebrated symbol in the south. It was the ensign of the Pandyan dynasty who are thence called *Minavars* and their standard the *Minkodi.* It also occurs on Buddhist seals.

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* By a mistake of the engraver these though distinct have been numbered as one coin.

Of the symbols more particularly associated with the worship of Buddha, the *chakram* or wheel is the most prevalent and occurs on every coin, sometimes in the form of a disk surrounded by rays, sometimes with rays alternately resembling an umbrella and a loop containing the crescent shaped termination of a Buddhist *chaitya.*

The *chaitya* emblem is also of frequent occurrence its most common form being a pyramid of two arches surmounted by a third or the pyramid may consist three or more tiers of arches. Examples occur on figs. 9, 10, 12, 22, 23 and 26.

The uppermost arch of the *chaitya* is often surmounted by a ball and crescent, but is not so represented on any of the coins now figured. The ball and crescent however is met with frequently, either single, as in figs. 16 and 19 or associated with other emblems, as in the case of the *chakrams* already mentioned and on figs. 19 and 27 with a plough. It is also found on the Sah coins of the Surashtrian series where it has been conjectured to represent a numeral.*

The tree sacred to Buddha (*Ficus religiosa*) is seen on figs. 9, 13, 18, and 26.

On 5½ and 11 are represented a symbol which has been compared to a cadeuceus and which also bears some resemblance to the numeral taken for 9 on the Surashtrian coins.† It occurs likewise on the Behat Coins.‡

On fig. 18 and several others (not figured) is a bow and arrow on fig. 7 a hand,§ &c. &c.

The next class of coins contains those represented by figs. 28 to 35. Here the execution is better and there is a gradual transition from the use of punches to that of a matrix or die embracing the whole surface, but on one side only, and then to the employment of a double die with impressions on both sides.

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* Jour. R. As. Soc. Vol. XII. p. 36.

† Ibid. also Jour. As. Soc. Beng. VII. p. 349—354 and Pl. XIX.

‡ Jour. As. Soc. Beng. III. Pl. XXV. Fig. 1.

§ Ibid. VII. Pl. XI. Fig. 2.

They are known generally by the name of *mádas* and *tankas** as *padma tanka, kamala máda.* All the examples we have met with are of gold. They are generally, but not always irregularly cup-shaped, the obverse being concave, the reverse convex. The obverse generally exhibits five impressions in relief, a central or normal one surrounded by four others subsequently applied. The symbols are for the most part of a Buddhist character.

Figs. 28 and 29 are examples of a kind not unfrequently met with to which the name of *padma tankas* more particularly belongs.

Obverse; normal symbol a lotus or *padma*, the *śank'h* or sacred shell on one side, on the other a weapon with a legend in Nagari characters, a large portion of which has been lost in the

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* This term seems to be taken from the Tamil word தங்கம் a verbal noun signifying that which is heavy, hence applied to gold as the heaviest metal and more especially to the finest gold or that of 10½ touch. The term may still be recognized in the Telugu word *tankam* టంకము and the Dak'hani ٹکہ *taka* which to this day are used to signify a sum of sixteen *paisas* or *dabbs* (equivalent to annas 5, pice 3,) and in the native name for a mint *tankaśala.* In Shakespear's dictionary the meaning of ٹکہ *ṭaka* is given as "a copper coin equal to two *paisa.*" But no such coin is known in the Dak'han or the Northern Circars now, the term being applied to a mere nominal expression of value, remarkable for its reference to the 16 or anna sub-division of a normal standard. Wilson derives the word *tankasala* from *ṭanka* " an instrument, a weight equal to 4 *mashas,*" as if it were a pure Sanscrit word in which the hard Nagari *ṭ* takes the place of the soft Tamil த. It is probable therefore that the Tamil term comes originally from the Sanscrit and this is the more likely, because the old Tamil name for a mint is கம்பட்டம் *kambaṭṭam* a word which by the way, Dr. Caldwell also derives from the Sanscrit. Comp. Gram. p. 57.

The word *máda* is the Telugu term for a half pagoda. It occurs frequently in that sense in old inscriptions as does the old term for a pagoda *gadyanam.* In the *Lilavati* the weight of a *gadyanam* is stated to be 48 *gunjas.* A *gunja,* the red *abrus* seed, averages about 2 grains. A *máda* therefore should weigh 48 grains. Most of our specimens exceed that standard, though some not greatly.

periphery. The intermediate symbols are likewise imperfect, but are probably the same as those which will be afterwards described as frequent in this kind of coin resembling the letter ఖ Rev. plain.

The weapon occurring with the legend on two of our specimens is a bow, on a third a fork. Professor Wilson has figured two from drawings in the Mackenzie collection,* one of which has a sword, the other a mace. The legends which are more perfect in his figures, he reads *Sri Sri Mahadéva*, but this version does not correspond with the drawing. On our exemplars the words appear to be *Sri-ráma.* In neither case do they afford evidence of origin.

They were obtained from Banawassi in the province of Soonda, and weigh from grains 57·55 to 58·3. Colonel Mackenzie's are noted on the drawings as from Tripati and Honaver, but Professor Wilson believes them to be identical with those entered in the catalogue under the name of "*kamala mudras* from Banawassi."

Figs. 30, 31, see below.

Fig. 32, obverse: central or normal symbol nearly obliterated, on one side a vase with a ball resting on its mouth which may refer to the *kama-kumbha* or vase of desire, the Hindú cornucopia, a common emblem on Buddhist coins and sculptures; opposite to it the letters విజయ which in modern Telugu reads *vijaya*; in the intermediate spaces a scroll like the Telugu letter ఖ with the tail prolonged so as to pass twice round the letter itself or it may be *Sri* శ్రీ.

Reverse plain; with a single indentation or fixing-point? near the edge.

From the western coast: weight grains 58·2.

Fig. 33. Obverse: although in good preservation, and the impression sharp, it is difficult to discover what the symbols refer to. The normal design presents a number of dots over the whole surface, some larger, some smaller. In one specimen they may almost be taken for rude representations of four *sinhás* or lions. Some of them are cut by the lateral stamps, one of which contains imperfect Telugu letters of antique form, too indistinct to be read; the

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* Asiatic Researches, Vol. XVII. p. 594, Pl. IV Figs. 88, 89.

opposite symbol is unintelligible and between them are the double tailed శ్రీ or ஸ்ரீ.

Reverse smooth : five of these were obtained in the Ceded Districts near Kurnool, and weigh from grains 54·25 to grains 54·55.

Fig. 34. Obverse: central symbol indistinct. Of the lateral ones the శ్రీs are replaced by a circular figure prolonged into two points like a bud or seed, with two or three encircling lines; in Nagari characters are the letters *gámaga* or *rámaga* and below the *śank'h* shell and *chakram*, now sacred to Vishnu.

Reverse plain; weight grains 43.90.

35. Obverse : central figure, Krishna, as the *muralid'hara* or flute-player; on either side the double tailed శ్రీ or ஸ்ரீ; above, the sun and moon with a tricuspid symbol between them; below unintelligible.

Reverse plain; unique, from Tanjore; weighs grains 53·25.

The figure of Krishna in the same character occurs not unfrequently on small copper die-coins of Raja Raja Deva Chola.

Fig. 31. Obverse : a single symbol covering the whole surface and representing a *chakram* or wheel with eight rays which are of two forms alternating with each other, in the manner of those on the flat silver coins already described. The coin being worn these are not clearly shown in the engraving.

Reverse : four small indentations near the periphery, one of which is flanked by two smaller, deeper cavities, one on each side. These are simple while the larger ones contain a point or dot in relief.

From the Dharwar district in the Southern Mahratta Doáb; weight grains 66·9.

This appears to be a true die coin with an impression on one side only.

Fig. 30. Obverse; a seat or chair, on which rests a sphere or cushion surmounted by three other spheres, the whole in a shrine or portico of a temple; on either side a portion of a vase, like the *ka-*

ma-kumb'ha, may be perceived and above the sides of the portico, representations of the lotus. This is a subject of frequent recurrence in Buddhist sculptures, and may be seen repeatedly on the sculptures from Dipaldinni in the Central Museum.

Reverse : a scroll or arabesque of foliage. This appears to have been adopted very generally for the reverse of the earliest double die coins of which we shall find repeated instances as we go on, from all parts of the country.

From the Ceded Districts ; weight grains 60·1.

These last examples conclude the series of the earlier descriptions of coinage, by bringing us to the introduction of a more improved system of mintage. But it will still be necessary to recur to earlier and less perfect specimens in describing future plates, in which it has been found necessary to arrange the pieces with reference to the prevailing type represented on them, in default of means for ascertaining their connection more accurately, on historical and chronological data.

Pl. IX.
Sinhá type.

The lion is one of the most favorite symbols represented on Buddhist sculptures. It forms the crowning ornament of th celebrated *lat'hs* or columns of northern India, the most remarkable of which are the Allahabad column, those of Bettiah, Bakra &c., described in the Journal of the Asiatic Society of Bengal.* It occurs prominently among the ornaments of ancient and modern dehgopes. Among the marbles from Dipaldinni in the Central Museum are statues of the lion which occupied the summits of *lat'hs* or pillars at the gateways of the edifice and representations of winged lions, reviving associations with the Arian origin of the founders of Buddhism, appear in bold relief on the friezes, in the same collection. It was to be expected therefore that this animal would form a favorite symbol on the coinage of the sect and Plate IX. exhibits examples of its application to such a purpose.

Figs. 34, 35, 36*a*, all of gold, bring us back to the punch-coins. Obverse off 34 ; normal symbol a *swastika* or cross with the limbs

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* J. A. S. B. III. 105, 482. IV. 121, 125.

bent at right angles in the same direction, surrounded by four punched impressions of lions, which a herald would describe as passant regardant. Reverse the scroll ornament, [vide fig. 30,] and two indented marks.

Figs. 35, and 36*a*, only differ in the normal symbol which in the former is a *padma* or lotus, but in the latter the form intended to be represented is not distinctly defined.

These were all obtained in the Southern Mahratta Country and weigh respectively grains 58·825—58·525—58·45.

Figs. 36*b*. and 37, are representations of two gold coins, which with eight others were found at the village of Hevali in the southern Konkan in 1844, and were presented by the Government of Bombay to the Asiatic Society of that Presidency from whose Journal the figures are copied.* They belong clearly to the same type as figs. 34—36*a*.

Fig. 36*b*, obverse; normal figure, a lion passant, with four similar lions subsequently impressed on the four sides between two of which is the symbol described above as resembling the letter or and between the two others, one stamp containing letters and another opposite to it of some unintelligible device. This coin is interesting as exhibiting eight separate stamps besides the central one, which from the drawing appears to have been also impressed by means of a punch.

Reverse; not figured, but as two of the coins are stated to have been quite plain in the reverse, this was probably one of them; weight stated to be 63 grains.

Fig. 37, obverse; a single figure of a lion passant, regardant, with a legend in old Telugu or Canarese letters below.

Reverse, a scroll or arabesque of foliage in the centre, surrounded by a circle of dots, and that again by an outer circle in which an ornament resembling the Greek letter ϕ or a circular buckle, alternates with a trefoil.

This type to which the majority of the Hevali specimens appear to have belonged, has all the appearance of being a die-coin, but

* Vol. II. p. 63, Pl. XII. figs. 1, 2, 3.

the two indentations conjectured to have been fixing-points, occur near the edge of both. Dr. Bird reads the legend *balya sri*, but it more nearly resembles the Canarese word *sri-ga* or *sri-ma*. The scroll on the reverse he appears also to have considered to be letters, which he reads as giving the name Rudra and hence identifies them with Pratapa Rudra Deva, the last King of the Kakateya dynasty of Warangal. We consider however that these coins belong to an earlier age than the 13th century, the period during which Pratapa Rudra flourished and should be inclined to ascribe them to some of the older dynasties, as the Kadamba, which about the fifth or sixth centuries ruled at Banawassi and other places on the western coast, in which quarter all the specimens hitherto discovered have been found. The weight of all is stated to be about 63 grains.

Figs. 38, 39, 40, 42, 45, 46, 47, are gold fanams from various parts of the country.

Fig. 38, obverse; a lion passant with a sword in front. Reverse; a legend in an old form of Nagari which may be read *usli*, a word to which no meaning attaches.

Three of these were found at Bezwàda in making excavations for the anakat and were received from Captain Orr. They belong to the same type as fig. 48—50, and weigh exactly grains 6·8.

Fig. 39, obverse; a lion passant, reverse the Telugu letter o, ఒ.

This was obtained from Cuddapah and weighs grains 5·85. We also possess an example in silver precisely similar in device and weighing grains 5·45.

Fig. 40, obverse; a lion passant gardant, reverse a legend in old Nagari {|२४ which may be read *sri dèva* or *sri dema*.

These are from the ancient city of Chandragiri, near Tripati. They weigh 3 grains. [See No. 47.]

Fig. 41, by an error of the artist in engraving the numbers, a single No. 36, has been affixed to two distinct coins which have therefore been subsequently distinguished as *a* and *b*, and No. 41 has been omitted altogether.

Fig. 42, obverse; a lion passant: reverse; a Telugu legend, very indistinct; from Vengipuram; weight grains 5·95.

Figs. 43 and 44, two silver coins; obverse; a lion passant: reverse; the words which from a collation of three specimens appear to be *ràj ad'hi ràja* in somewhat modern Nagari character. These are from Canara and weigh grains 10·7 to 11.

Fig 45, obverse; a lion passant: reverse; in old Telugu the word మ్బ *mba* for *mba*, a name of Parvati or Durgi.

It has been worn as an ornament, and the weight grains 7·525, does not give its true value.

Fig. 46. A lion passant. Reverse, the Canarese letter ಚೆ *che*, which may stand for Chella or Chellappa Raya, a name of Vishnu: under which he is worshipped at Mélkottai in Mysore.*

Fig. 47, obverse; lion passant gardant: reverse; plain. This belongs to the same type as fig. 40, but has been represented much too large; it weighs only 3 grains to 3·1.

Figs. 48, 49, 50, 52, belong to a type of copper coins occurring extensively in the Masulipatam district and corresponding with fig. 40. The locality and general character lead us to attribute them to the early Buddhist dynasty of Vengi, the ancient name of southern Telingana, the capital of which was situated near Ellore.† Of these early sovereigns we possess scarcely any historical traces. The names of two of them Rajah Vachi Varma and Nandi Varma are given in the inscription printed in the volume of Madras Journal already referred to. The Chalukyas of Rajahmundry, an offset from the dynasty of the same race already established at Kalyan, appear to have effected their entrance into Telingana Balaghat, by the conquest of Végi about the 6th century.

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* Taylor's Cat. Rais. Or. MSS. I. p. 510.

† See a notice of this ancient city in Madras Journal, vol. XI, p. 304. We have since visited the spot which is about five miles north and a little west of Ellore on the road to Nagpore, via Badrachalam and exhibits extensive remains of walls and fortifications with the ruins of the Chitrarat'ha Swami-gudi still bearing the same name. Two small modern villages occupy a trifling portion of the ancient site which are still called Pedda Vegi and Chinna Vegi.

Fig. 48, obverse ; a lion passant with a sword in front and above a Telugu legend పవమసి which may be read Pavamasi.

Reverse ; three *st'hambas* or poles ? From Bezwadah ; weighs grains 4·15.

Fig. 49, obverse ; a lion passant with an indistinct symbol over his head and a flower over his uplifted forefoot.

Reverse ; a sword with a broad truncated point resembling the *khánda* or national weapon of Orissa and a Nagari legend which may be read *Ratadeva-ttárta* or *Ratadeva gupta ?* Unique ; from Dipaldinni.

Figs. 50 and 52, obverse ; a lion passant with a sword above and a symbol like those on the reverse of fig. 48 in front ; [the two latter are wanting in fig. 52.]

Reverse ; on both, (that on 50 being imperfect,) a symbol which may designate either the vase of plenty, [*kama-kumbha*] with candelabra on either side or it may represent a dehgope with its accompanying pillars or *st'hambas*.

These coins are generally very thick and much oxidised ; sometimes they are found to be partially plated with silver or other white metal and are then in better preservation ; they occur numerously throughout the Masulipatam district, but from their great age, perfect specimens are rare.

Figs. 51 and 59, are small leaden coins which have been introduced to illustrate fig. 54, the one exhibiting the lion, the other the elephant. They are not uncommon about Amaravati.

Fig. 53, a leaden coin from Dipaldinni : obverse; a lion with the tree symbol in front : reverse ; the *chaitya* symbol ; weight, grains 226·9, [see fig. 57.]

Fig. 54, a square copper coin, having a remarkable coincidence with a class of coins occurring in the Panjàb and Affghanistan.*

Obverse ; a lion passant : reverse ; an elephant with a *chatra* or umbrella and another small symbol above. Others instead of the

* J. A. S. B. III. Pl. IX. F. 19, IV. Pl. XXXV. Figs. 50, 51. Wilson, Ariana Antiqua, P. 415, Pl. XV. Figs. 26, 27, 28, and Pl. XIX. Figs. 11, 12.

elephant have an *ankús* or elephant-goad, a bow or other implement. They were found at the village of Kurupàd in Guntoor. A similar square coin of lead with a lion on the obverse and the reverse blank like fig. 51, was obtained from Dipaldinni.

Fig. 55, is a gold coin copied from Moor* who saw it in the cabinet of Major Price by whom it was purchased at the sale of Tippoo's property after the capture of Seringapatam. It was probably therefore found in Mysore.

Observe; a nondescript animal which Moor calls a lion, but which resembles rather the fabulous monster having the body of a lion with an elephant's trunk and tusks, in Tamil called *yáli*; in Sanscrit *Śarab'ha* a sword or mace over the back and a cross or flower under its feet.

Reverse; a legend in Canarese which having been copied by one ignorant of the language is too incorrect to be read although several letters are recognisable.

Fig. 56, a copper coin; obverse, the face of a lion: reverse, a sword between the sun and moon. The sword is of the peculiar short form so often represented on Hindoo sculptures.

Fig. 57, a square leaden coin from Dipaldinni resembling fig. 53, but without the tree symbol.

Leaden coins of this description are very common in the neighbourhood of D'haranikótah and Amarávati, of all sizes, often like fig. 51, with the reverse plain. Wilson has figured two from the Mackenzie collection of this description† said loosely to have been found at Mahamallaipuram and Nellore, but more probably at Amaravati. The lion bears a striking resemblance to that on the coins of the Bactrian kings Agathocles and Pantaleon‡ and again on those of their barbaric successor Azes. But Wilson calls the animal on the coins of the former a panther and that on the latter only, a lion. The former however both in attitude and general form is almost identical with the animal represented on these leaden

* Hindu Pantheon, P. 434, Pl. 104, Fig. 7.

† As. Res. XVII. Pl. v. Figs. 117, 118.

‡ J. A. S. B. III. Pl. ix. Figs. 17, 18. Wilson Ariana Ant. Pl. vi. Figs. 7, 8, 9, 11 and Pl. vii. Figs. 8, 9.

coins. They are of all weights and sizes. This one weighs 14·4. We have received them frequently from the districts of Guntoor and Masulipatam along the valley of the Kistna.

Fig. 58, is copied from a MS. drawing of Col. Mackenzie representing a silver coin with the note "from Sehore, November 1819."

Obverse; a lion passant. Reverse; a Nagari legend which may be read *Sri tarpi deva.*

Fig. 59; see Fig. 54.

Fig. 60, a leaden coin in the Government Central Museum where there are two specimens, numbered 40 and 41.

Obverse; a lion passant. Reverse; the short, straight, Indian sword; on the other, the reverse is different, but is very indistinct and resembles a large S shaped scroll.

Fig. 61, belongs to a type of which several specimens have been received from the Salem district, and of which a more extended notice will be given hereafter. This particular one has been selected for this plate, because the figures both on the obverse and reverse are connected with the series now under review.

Obverse; a lion sitting on his hind quarters (sejant, gardant) between two pillars on his right and a *chakram* elevated on a pillar on his left.

Reverse; a bow and arrow as in fig. 13 of the punch coins.

Fig. 62, a copper coin from an uncertain locality.

Obverse; a lion passant regardant. Reverse; a pagoda resembling a Chinese temple or it may be intended for a *rat'ha* or idol car.

Plate X.
Elephant Type.
Bull Type.

In the preceding series we have seen the elephant appearing conjointly with the lion on the Buddhist coins of Bactria and of southern India, and also as the most frequent symbol occurring on the punch coins in Pls. VII. and VIII. In the following examples, the same animal is represented as the typical figure of the series with various Buddhist symbols on the reverse.

Fig. 63. Is a copper coin of square form received from the ancient site of Wurrioor [Uraiyur] near Trichinopoly.

Obverse ; an elephant. Reverse ; a cross in a heart shaped diagram without motto or accompaniment of any kind ; weight grains 111·45.

Figs. 64, 65, two copper coins from Dipaldinni.

Obverse ; an elephant with uplifted trunk and a legend : reverse ; the four-limbed *chakram*.

Fig. 66, a small copper coin, from the Masulipatam district.

Obverse ; an elephant with a staff over the neck and a radiated border : reverse ; a series of lines and dots intended perhaps for a temple or portico. This coin forms a link connecting the elephant with the lion series of the (supposed) Vengi dynasty.

Fig. 67, a small copper coin of more modern date.

Obverse ; an elephant with one hind leg out stretched as if kicking and the tail raised over the back.

Reverse ; an upright rod with some resemblance to an *ankus*, but much defaced or it may be a candelabra, or pillar between two rings.

The posture of the elephant connects it with a more recent series having a Telugu legend on the reverse, which will be described hereafter.

Fig. 68, a copper coin, also more modern.

Obverse ; a female figure seated, with a lotus in either hand and two elephants pouring water over her.

Reverse ; indistinct, but apparently two or three lines of what may be Nagari characters too much defaced to be read.

The sitting figure under the modern name of Gaja Lakshmi may be frequently seen as an ornament in the centre of the lintels over the doors of ancient temples and also over the sluices of old tanks. It appears to be an undoubted Buddhist emblem, although claimed by modern Hindus as appertaining to their mythology. Fig. 73 belongs to the same type.

Fig. 69 to 72, are leaden coins, of similar type to figs. 64 and 65.

Obverse ; an elephant with uplifted trunk and traces of an imperfect legend : reverse ; the four-limbed *chakram*.

Several specimens of this type have been found at Dipaldinni, Gudiwadah and other places in the Guntoor and Masulipatam districts, and in 1826, a large hoard was discovered in the lands of the village of Màgalli, within three or four miles of kasbah Nandigam. The head of police on the 4th August reported to the magistrate that the Munèru river, having overflowed its banks, had washed away the soil and laid bare some earthern pots filled with leaden coins which weighed altogether about 105 lbs. They were sent to Masulipatam and lay for many years in the treasury. The greatest portion consisted of the elephant type, but a few were found with the figure of a bull.

Fig. 73, obverse ; an elephant passant : reverse ; a female figure seated holding a lotus in either hand, this appears to be a representation of the Buddhist deity Padmavati.

The Bull series.

The important position occupied by the bull both in Buddhist and Sivaite mythology renders it a favorite symbol with the votaries of both creeds. Accordingly we find a great number of coins impressed with its image. It was early adopted by the successors, of the Greek conquerors of Bactria, appearing with a conspicuous hump on a square copper coin of Philoxenes about 130 B. C. and a few years later on the more elegant round and square *hemidrachmas* of Apollodotus with an elephant on the reverse.* It occurs frequently on the coins of Azes, also associated with the elephant and again with the lion, camel &c. and on those of Kadphises the first Indo Scythian prince, standing behind a figure of Siva.† With the extension of the Sivaite creed in India its symbolic adoption became almost universal.

Fig. 75, is a leaden coin found in the sea shore between Mahamallaipur and Madras with a bull on the obverse, and the reverse plain : weight 88 grains.

Figs. 76 and 77, are copper coins belonging to the so called Vengi series. They are found in the same part of the country but

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* Wilson, Ari. Ant. Pl. II. fig. 18, Pl. IV. figs. 14,15, Pl. VII. figs. 8—10. J. A. S. B. Vol. IV. Pl. XXI. fig. 2, Pl. XXII. figs. 1—8. Pl. XXIII. fig. 28, Pl. XXVI. fig. 5.

† Ar. Ant. P. 350, Pl. XI.

less numerously and exhibit the same general character. It is difficult to say what the central figure on the reverse is meant to signify. Wilson figures a specimen of this series from the Mackenzie collection with the same reverse, but an elephant on the obverse, which thus serves as link between figs. 76 and 77—66—and 48, 50, 52. The weights of these are—fig. 76 grains 64·9—and fig. 77 grains 86·5, but small quarter pieces also occur varying from grains 10 to 25.

Fig. 78, is composed of a sort of inferior white metal with a bull on the obverse and the reverse plain, weighing grains 30·75. It was found near Palaveram with several others of similar description, some having the bull obverse, others a horse, all of which came into the possession of Lieut. Col. F. Clerk, late of the 3rd or P. L. I. Regt. from whom the specimen here figured was received. Prinsep describes a similar kind of money among the relics of Behat, the composition of which he calls white bronze, and the general aspect and execution of which bear a strong analogy to this and the succeeding figures.*

Figs. 79 to 89, belong to a remarkable series of very thin and frequently much broken copper coins found along the sea-shore, after the sand has been disturbed by storms or high winds, to the south of Madras, in company with Roman, Byzantine and a few Chinese coins. The figures are often struck with considerable elegance, the obverse being always a bull sometimes with a short legend and various reverses, as a *chakram* or wheel in figs. 79, 82, and 83 ; a ship with two masts like the modern *d'honi* save that it is steered by paddles from the stern, in fig. 81, 88 ; a tree in 80 ; a bow, in 84 ; a crab in 85 ; a fish in 87. The reverses of 86 and 89 have not been recognized.‡ The leaden coin fig. 74 has been introduced from its resemblance to figs. 81 and 88. It was found near Allamparva between Sadras and Cuddalore.

There can be little difficulty in attributing this series to the aboriginal people of Drávida-désam, the Curumbars and their

* J. A. S. B. Vol. III. p. 229, Pl. XVIII. figs. 11, 12.

† We have a leaden coin from Dipaldinni of the Sinha series with a similar reverse and four undulatory lines for the water symbol.

princes of the Pallava race* who were overcome and destroyed by the natural son and successful general of one of the Cholas (probably of Raja Raja Chola or Rajendra Chola) and their country incorporated with the Chola dominions under the names of Tondamandalam and Jayam-konda-Chola-mandalam about the eighth or ninth century.

These coins therefore may be assumed to have been struck in the seventh and eighth centuries. The frequent representation of a ship, as in figs. 74, 81 and 88, indicates the existence of commercial pursuits, and the fact that all the specimens in our possession have been picked up on the sea shore at different points between Madras and Cuddalore, and that they occur with copper coins of the lower Roman Empire and with Chinese money shows that the commerce must have been tolerably extensive. The following extract from the Revd. W. Taylor's analysis of the Mackenzie MSS. throws some light on the subject. The volume in which it occurs appears to be a collection of traditions connected with the ancient history of Tondamandalam, made for Col. Mackenzie:

"After the deluge the country was a vast forest inhabited by wild beasts. A wild race of men arose; who, destroying the wild beasts, dwelt in certain districts. There were then, according to tradition, no forts, only huts; no kings, no religion, no civilization, no books; men were naked savages: no marriage institutions. Many years after, the Curumbars arose in the Carnatic country: they had a certain kind of religion; they were murderers; they derived their name of Curumbars from their cruelty. Some of them spread into the Dravida-désam as far as the Tonda-mundala country. They are now found near Uttramalur;† but more civilized. They ruled the country some time, but falling into strife among themselves, they at length agreed to select a chief, who should unite them altogether. They chose a man who had some knowledge of books; who was chief of the Dravida country, and was called Camanda Curumba-prabhu, and Palal (Pallava?) Rajah. He built a fort in Puralur.‡ He divided the Curumba land into twenty-four parts and constructed a fort in each district. Of these, the names of ten are—

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* Mad. Jour. Lit. and Sc. Vol. XIII. p. 52 and Pt. ii. p. 43.

† A tower in the Chingleput District 40 miles W. of Madras.—W. E.

‡ Now Poral or Pozhal or Madavaram, the village at the Red Hills, near Madras.—W. E.

Puralur, the royal fort, Callatur, Amur, Puliyur, Chembur, Utthikadu, Kaliyam, Venguna, Icattukottai, Padavúr. While they were ruling, there was a commerce carried on by ships. As the merchants of Caveripum-patnam sought trading intercourse with them, the Curimbas built the following forts (stations) for trade: Patti-pulam, Sala-cupam,* Sala-pakam, Meyur, Cadalur, Alampari, Maracanam; whence, by means of merchants from Caveripum-patnam and the Curumbar, a commercial intercourse by vessels was carried on. They flourished in consequence; and while without any religion, a Jaina (Buddhist) ascetic† camo and turned them to the Jaina credence. The Basti which the Pural king built after the name of that ascetic, is still remaining together with other Bastis, and some Jaina images in different places; but some are dilapidated and some destroyed, by the hatred of the Brahmans. They were similar to the Jainas of the present day. They were shepherds, weavers, lime-sellers, traders. While living thus, various kings of civilized countries made inroads upon them, as the Chola and Pandiya kings, and others; and being a wild people who cared not for their lives, they successfully resisted their invaders, and had some of the invading chiefs imprisoned in fetters, in front of the Pural fort. Besides they constrained all young people to enter the Jaina religion; in consequence of which vexation a cry arose in the neighbouring countries. At length Adondai of Tanjore formed the design of subduing them, and invading them, a fierce battle was fought in front of the Pural fort, in which the Curumba king's troops fought, and fell, with great bravery; and two-thirds of Adondais' army was cut up. He retreated to a distance overwhelmed with grief; and the place where he halted is still called Cholan-pedu. While thinking of returning to Tanjore, Siva that night appeared to him in a dream, and promised him victory over the Curumbas, guaranteed by a sign. The sign occurred; and the Curumba troops were the same day routed with great slaughter: the king was taken, the Pural fort was thrown down, and its brazen (or bell-metal) gate was fixed in front of the shrine at Tanjore. A temple was built where the sign occurred; and a remarkable pillar of the fort was fixed there: the place is called Tiru muli vasal. A sort of commemorative ceremony is practised there. After a little more fighting, the other forts were taken, and the Curumbas destroyed. Adondai placed the Vellazhar‡ as his deputed aurhorities; having called them

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* Sala-cupam now Salvan-cupam near the Seven Pagodas, Cadalur is the modern Cuddalore of our maps, Alampari is Alamparva.—W. E.

† Probably one of Asokas Buddhist Missionaries.—W. E.

‡ The Vellalar or Vellazhar are still said to be of foreign origin and are also

into the country to supply the deficiency of inhabitants from the Tuluva-desam (modern Canara). They are called Tuluva-Vellazhar to the present day. Some were brought from the Chola-desam, still called Chola Vellazhar. He called from the north certain Brahmins by birth, whom he fixed as accountants. The Kondai Katti Vellazha, were appointed by him. He acquired the name of Chacravarti from rescuing the people from their troubles. The name of Curumba-bhumi was discontinued; the country was called Tondamandalam; and common consent ascribes to Adondai the regulation of the country."†

The mention of the brazen gates which it was thought worth while to carry away to Tanjore, the execution of the coins and the superiority of the older sculptures at the Seven pagodas, as on the *rat'has*, prove that the arts had kept face with commerce and that the Curumbers must have attained a considerable degree of civilization.

Fig. 90, the concluding coin of this plate has been introduced on account of the similarity in form and execution of the bull with those just described and as forming a link with the Chola series of coins to be noticed hereafter.

Obverse; a standing figure rudely designed, the right hand resting on a mace or sceptre, the left raised.

Reverse; a bull with a crescent over its back.

The Horse Type.

The association of the horse with military operations has at all times and in all countries caused it to be emblazoned as a distinguishing mark of warlike nations. Although not peculiar to the Buddhists it was a favorite symbol and occurs on many coins of the period of their ascendancy.

Figs. 91 and 99 have been selected for their more perfect reverses from a number received from Cuddapah.

Obverse; a horse with an anchor-shaped symbol above and a sphere or circle in front.

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called the Ganga Kula. A similar tradition exists in Canara of the emigration of the cultivating class from Ahech'hatra at the instance of an early Kadamba King. The tradition in the extract seems to refer to a second emigration of this same tribe.—W. E.

† Mad. Jour. Lit. and Sc., Vol. VII. p. 316. Jour. As. Soc. Ben., Vol. VII. p. 403.

Reverse; a dehgope of three tiers surmounted by a crescent, by its side the sacred tree, below which is the wavy line supposed to designate water* with dots in the undulations.

These are large leaden pieces, weighing grains 105·7 and 116·75 and of indifferent execution, the figure of the horse being rude and stiff.

Figs. 92, 96, and 98, obverse; a horse with a legend extending round the whole periphery: reverse; the four-armed *chakram*.

These which are also of lead, are found in the Guntoor district, about Dipaldinni and its neighbourhood. They are only half the size of the preceding specimen, and the design is remarkably good, but owing to the softness of the metal few of the letters retain their sharpness. The weight of the two larger pieces is, of the one, grains 82·2, of the other 59·75 that of the smaller or quarter pieces like fig. 98, is grains 14·1 to 20 and 22.

Figs. 93 and 97, are square copper coins, locality whence procured unknown. In execution and faulty design they resemble the Cuddapah specimens. The symbol in front of the horse in fig. 97 appears to be an altar; the design on the reverse is an ornamental band. They weigh grains 51·35 and 60·3.

Fig. 94, is a circular coin of white metal found at the same time and place, and in all respects similar to the bull coin fig. 78.

Obverse; a horse with a sphere in front and a small portion of the letters of a legend visible above.

Reverse; the base of the sacred tree and a part of a dehgope only visible, with the line designating water below, as in figs. 91 and 99; weight grains 39·75.

Fig. 95, a small copper coin from an uncertain locality.

Obverse; a rude figure of a horse: reverse; a *padma* or lotus.

Miscellaneous Types.

From fig. 100 to 108 are coins of a miscellaneous character but of Buddhist origin.

Fig. 100 and 101, in lead, have on the obverse, a dehgope, below which is the symbol of water, and the latter a *svastika* in addition, with a legend much defaced. From Dipaldinni where they are tolerably common; weight from 70 to 90 grains.

* Jour. R. As. Soc., Vol. XII. p. 25.

Fig. 102, a copper coin, locality uncertain.

Obverse; a female figure (Padmavati?) seated and holding a lotus in each hand (see figs. 68 and 73.) Reverse; a nondescript symbol resembling spiked poles between two ladders; [See reverses of figs. 76, 77.]

Fig. 103, a thin copper coin from the sea shore near Madras.

Obverse; a dog: reverse; four dots within a circle. This is a unique specimen, and the only example that has been met with of such an animal serving for a monetary device, but Prinsep has figured several pieces from the Stacy collection in his plate of earliest Hindu coins* in which a dog is the principal figure. The weight of this is grains 43·9.

Figs. 104, 105, 106 and 107, are leaden coins from Dipaldinni similar to figs. 100 and 101, but in which the *chatiya* emblem assumes the form of a solid mound or dehgope. Fig. 105 is a remarkable, unique specimen of large size weighing grains 224·15, having on the obverse the dehgope surmounted by a crescent, the water symbol beneath, and the *padma* and *sank'h* shell on either side with a legend extending round the edge but the letters much flattened and the outlines pressed into each other. Reverse; the four-limbed *chakram*.

Fig. 108, is a very thick copper piece with a plain reverse, the obverse exhibiting the base of a *chatiya* of two rows, the third and uppermost being omitted and with a dot in each of the arches. It fills the whole of the upper part of the field which is deeply excavated, the lower half containing a circle and crescent. This has more the character of a weight than of a piece of money. It is exactly equal to grains 105·35.

The remaining figures 109, 110, 111 and 112 represent copper seals picked up on the sea-shore with the coins figs. 75 to 89 and therefore attributable to the old Buddhist inhabitants of Maha-Malleipuram and its dependencies. The use of material of which they are composed and which accounts for their acquisition and appearance here, is illustrated by an injunction occurring in M. Csoma

* Jour. As. So. Ben. Vol. IV. p. 628 and Pl. xxxv. figs. 34—36.

Körösi's analysis of the Dulwa portion of the sacred Thibetan work entitled the Kah-gyur where the 11th leaf of the 10th Vol. is thus epitomised:—"Seals are permitted to priests—excesses in regard to seal rings. They are forbidden to have them of gold, silver or precious stones. They are prohibited from wearing rings. But they may keep seals or stamps made of copper, brass, bell-metal, ivory and horn."*

Fig. 109 is a quadrilateral seal having an animal on each of its sides and on its face viz., a horse on the face and on the sides two tigers or lions, a fish with a crescent and a monkey.

Fig. 110 is circular and has the vase of desire [*Kama-Kumbha*] on its face.

Fig. 111 also circular, exhibits an animal something like a frog, between two candelabras, and

Fig. 112, a cock.

XIV. *Notes on various Subjects.* *By* Lieutenant H. P. Hawkes, *Sub-Assist. Comy. General.*

No. 1. *Entomology. On the best material for lining an entomological cabinet.*

The unsuitability of English-made cabinets for use in India, is a source of much trouble and annoyance to the Indian Naturalist. The mere *form* of the case is of very secondary importance, provided portability has been ensured; so also is the *material* of which it is constructed, although where there is a choice, *tin* is to be preferred from its being safe from the attacks of white ants; but it is chiefly on the *lining* of the cases that the value of the cabinet depends. The principal things to be *desired* in a good lining material are, that it should afford a firm hold to the pins which confine the specimens, that it should be unaffected by changes of tem-

* As. Res. Vol. XX. Pl. 86.

perature, that it should be sufficiently cheap and easily procured, and lastly, that it should not afford harbour to insects.

A cabinet lined with a material that does not give a sufficiently tenacious hold for the pins is worse than useless. In the jolting of a voyage or march a large and heavy insect gets detached, is rattled about the case amongst the other specimens, and destroys in a few hours the labours of years.

Cork is the material in most general use in England for this purpose, and is procured in large sheets which are cut to the requisite thickness, and after being glued to the bottom of the case, the whole is covered with a sheet of paper. In a cool climate this answers sufficiently well, but in India the sheets of cork too often become detached by the heat, whilst the numerous pores which perforate it in every direction, afford abundant shelter to myriads of insects, which speedily destroy the contents of the case.

Shola commonly called *pith* (the stem of the *Œschynomene aspera*) is frequently used in India, as is also the very soft wood of the *Erythrina Indica*, but with the same results. Solutions of arsenic or corrosive sublimate will preserve all these substances *for a time*, but as far as my experience goes, no amount of these drugs will secure them from destruction for any lengthened period.

The substance which I have used with the greatest success, meets all the requirements of a good *lining material.* It affords a very tenacious hold to the pins, is unaffected by ordinary changes of temperature, is procurable in every bazaar, and affords no harbour to insects. In addition to this, it does not require the application of any poisonous solution, being in itself indestructible by vermin. The receipt is as follows :

℞ Common rosin or dammer	16	ounces.
Yellow wax	8	,,
Turpentine	1	,,
Camphor	1	,,

Pound the rosin and melt it slowly, then add the wax, and when thoroughly incorporated take it off the fire, and add the camphor previously dissolved in the turpentine.

To apply this composition, place the box, case, or drawer on a level surface, and when the liquid has cooled down a little, pour

it into the case until it stands about $\frac{1}{8}$th of an inch thick. When the mixture is on the point of hardening, cover it with a piece of white or colored paper previously cut to the required dimensions.

No. 2. *Entomology. On an artificial method of preserving a collection of duplicates of Lepidoptera in a portable form.*

Those who devote their spare hours to the study of the various branches of natural history in India, whether they prefer entomology, ornithology conchology or botany, cannot but have found, that the constant movements to which we are most of us subject, are a great impediment to these pursuits.

Collections of specimens in either of these branches are generally bulky, and the care, anxiety and expense involved in their transmission from place to place, do much to counterbalance the pleasure which these pursuits are calculated to afford. Any plan which tends to decrease the bulk of these collections, will, I am sure, be acceptable to collectors, and with this end in view, I proceed to recommend the adoption of a simple plan examples of which as a *pastime* many of us have no doubt seen, but of the *extended application* of which in the manner now proposed, I have never witnessed an example. We have our books of ferns, mosses and sea-weeds, and why should we not have a book of butterflies, which, independent of its portability and beauty, would be one of the most lasting ways of securing examples of these delicate insects.

I must premise however that the plan which is to a certain extent *artificial*, is intended to be applied simply and solely to the preservation of *duplicates*, and can never supersede or replace a collection of the perfect insects.

The mode of procedure is as follows. Chose a well bound blank book of convenient size, and having ready at hand a phial of isinglass size, (made by dissolving isinglass in alcohol) a pair of fine pointed scissors, and a camel's hair pencil, select the duplicate specimens which are not required in your cabinet, and cut off carefully the four wings close to the point of insertion. Lay then on a page of your book in the most natural attitude, and if you have two specimens of the same butterfly, show both the upper and

under sides of the wings. Trace the outline of the wings as they lie on the page with a fine lead pencil, then remove them gently with a camel hair brush, and cover the space within the pencil mark with a coat of size; replace the wings carefully, cover them with a piece of paper and press them with a marble slab or heavy weight. When dry remove the weight, and take away the skeleton of the wing, the whole of the delicate feathers will be found to have adhered to the paper in their natural order. With a brush and colors insert the body in the space between the wings, and give if necessary, a coat of size over the whole. The effect may be much enhanced by adding drawings of the larvæ and pupæ as well as of the plants on which they are usually found.

A collection of duplicates of many thousand specimens may in this manner be preserved within a very small compass, it has moreover the advantage of being indestructible by insects is very convenient for reference, and, although it can never supersede the cabinet, it forms a most convenient auxiliary to it.

SELECTIONS.

The Royal Society.

At the last meeting of the Society, a paper was read, entitled, *An Account of some recent Researches near Cairo, undertaken with the view of throwing light upon the Geological History of the Alluvial Land of Egypt*, by L. Horner, Esq., V.P.R.S.

This communication, which followed a previous memoir on the same subject, details at considerable length the results of the examination of the various soils and other substances obtained by numerous borings and shafts sunk in the vicinity of the statue of Rameses and across the valley of the Nile, in the parallels of Memphis and Heliopolis. The following are the chief facts made known by the excavation shafts and borings.

On examining the results of ninety-five excavations and probings of the alluvial land, it appears:—1. That the alluvium is of two principal kinds: first and chiefly, an argillaceous earth or loam, more or less mixed with fine sand of various shades of color, being the true Nile mud or sediment; and, secondly, pure quartzose sand, derived in a great measure from the desert, which is swept by violent winds through the gullies in the hills on either side, but chiefly from the Libyan range. 2. That the Nile sediment found at the lowest depth reached, is very similar in composition to that deposited by the inundation water of the present day. 3. That in no instance did the boring instrument strike upon the solid rock which may be presumed to form the basin between the Libyan and Arabian hills, which contains the alluvium accumulated through unknown ages, from the time when this depression in the earth's surface was formed, and the waters of the Nile first flowed through it. 4. That except minute organisms discoverable only by a powerful microscope, few organic remains were met with, and that those forms were recent land and river shells, and bones of domestic animals. 5. That there has not been found a trace of an extinct organic body. 6. That at the same levels great varieties in the alluvium have been found in adjoining pits, even when the distances between them are very moderate. 7. That there is an absence of all lamination in the sediment. When the author first undertook these interesting researches, he expected that sediment, slowly deposited on the land from nearly tranquil water, would present in sections a laminated structure—more especially as an able observer, the late Captain Newbold, stated that he had met with such an arrangement of the alluvial soil. It was therefore with no small surprise that on examining the soil from the excavations at Heliopolis, no such laminæ could be discovered, and in none of the excavations or borings has such a structure been met with in a single instance. There can be no doubt that a layer of sediment must be deposited upon the land, but as soon as the waters have subsided, the sun, the wind, and cultivation combine to break it up. From the earliest times when the Nile Valley was inhabited by man, the

alluvial land fertilized by the sediment from the annual inundation must have been cultivated in the returning seasons. The next following flood softens the hardened mud of the preceding year, and it is considered that this softening of the soil is one of the most fertilizing effects of the inundation. The very primitive and simple system of cultivation at the present day is, most probably, the same which has been followed for unknown ages, for it is said that in Egypt nothing changes. As the subsiding inundation level continues to expose to air and light the surface on which the sediment has been deposited in insulated patches of the uneven ground, the Fellah, wading in mud begins to throw seed upon them in contour lines, his light boat bringing to him his seed corn. As the retreating waters expose more land, as soon as it is sufficiently drained another zone of ground is sown, and so on until the lowest parts have received the seed, which must be cast before the surface begins to crack, and after it has been cast it is beaten down into the mud with a flat piece of wood attached to the end of a pole. During the dry season, when vegetation withers, and the underground water has subsided, the ground cracks in to numerous and deep fissures, forming the usual polygonal figures we see in dry mud or clay, affording receptacles for the flying sand. For three or four months in every year the surface of the valley stript of vegetation, in the state of a dry powder, is swept by violent winds, raising clouds of dust. By these combined causes, therefore, every trace of the deposited layer must be effaced. Instances of lamination and alternation of clay and sand, such as those mentioned by Captain Newbold, are not unfrequently met with on the banks of the river and at the entrances of canals, but they are local occurrences, caused by eddies and currents.

A further result of these researches is, that there are occasional accumulations of soil, the materials of which are only remotely derived from the inundation water and the storms of desert sand. In the neighbourhood of old buildings and on the sites of earlier buildings, where these have been constructed of crude bricks, the soil, to a considerable depth, may have been derived from the disintegration of these bricks. The soil thus derived would have

nearly the same aspect as the natural deposit of Nile mud. In the excavation at Heliopolis crude bricks were seen to have been the origin of the soil, these by visible rectangular lines chequering the sides of the pit. This last appearance, however, must be a rare occurrence, for the action of the inundation water softens the bricks and causes them to melt, as it were, into a homogeneous mass.

And finally, in nearly every part of the ground penetrated, artificial substances have been found, such as fragments and particles of burnt brick and pottery, and in the area of Heliopolis and Memphis fragments of statues and other sculptured stones. By far the most interesting *kind* of this nature was obtained from the lowest part of the boring of the sediment at the colossal statue of Rameses at a depth of thirty-nine feet. The boring instrument brought up a fragment of pottery, now in the author's possession. It is about an inch square, and a quarter of an inch in thickness, the two surfaces being of a brick-red colour, the interior dark grey. According to Mr. Horner's deductions, this fragment, having been found at a depth of thirty-nine feet (if there be no fallacy in his reasoning,) must be held to be a record of the existence of man 13,375 years before A. D., 1858, reckoning by the calculated rate of increase of three inches and a half of alluvium in a century—11,517 years before the Christian era—and 7,625 before the beginning assigned by Lepsius to the reign of Menos, the founder of Memphis. Moreover, it proves, in his opinion, that man had already reached a state of civilization, so far, at least, as to be able to fashion clay into vessels, and to know how to harden it by the action of strong heat. This calculation is supported by the Chevalier Bunsen, who is of opinion that the first epochs of the history of the human race demand at the least a period of 20,000 years before our Era as a fair starting point in the earth's history.

An appendix to Mr. Horner's valuable paper contains, among other matters, a description of the microscopic organisms in the Nile sediment: and the memoir is accompanied by various plans of the excavations and borings, with sections of the alluvium pierced through.

The author acknowledges with gratitude the assistance he has

received during the course of these interesting researches, which have extended over several years from our Consul in Egypt, the Hon. Charles Murray—from the late Viceroy, Abbas Pasha—and especially from the able engineer, Hekekyan Bey, who was educated in England, and of whom Mr. Horner gives a very interesting biographical memoir. The entire expense of the researches carried on during three seasons, of some original surveys, and the preparation of various maps on a large scale, and many drawings, amounting altogether to a very considerable sum, have been, with great liberality, defrayed by the Egyptian Government. The expense of analysing the soils sent to England was met by a grant of money from the Royal Society.—*Saturday Review, Feb.* 23.

The Geographical Society.

At the meeting of the Bombay Geographical Society held on the 21st January, the following letter from Captain Burton was laid before the meeting. The various references contained in it were made at the suggestions of the Committee of the Society in the correspondence with Captain Burton, and with Government in December 1856 :—

Zanzibar, May 25th, 1857.

Sir,—I have the honor to acknowledge receipt of your official leter dated the 8th December 1856, conveying to me, by order of the Geographical Society of Bombay, certain suggestions regarding the expedition into Eastern intertropical Africa, which I have been appointed to lead, and to express my gratitude for their valuable instructions and recommendations.

During my last preparatory journey from Mombator, on the Panjan river and thence by land to Fuga, the capital of an interesting mountain district—Usambara—I left at Zanzibar for comparison a barometer in charge of Mr. Frost, Medical Officer to the Consulate, the instrument (by Adie) obligingly lent to me by the Secretary of the Bombay Geographical Society. It would have done scant service during a coasting voyage, and on a rough

mountain tour, so delicate an instrument would certainly have come to grief. I took with me four thermometers be Newman, of which one, a B. P. Thermometer, was rendered useless by the mercury setting in the upper bulb, consequent upon expansion of air carelessly left in it by the manufacturer. I have now in all four strong Nutt's Thermometers, in good condition, and two B. P. ditto, one used by Captain William Smyth, R. N. in crossing the borders, and kindly given to us by Colonel Hammerton. These even should the "Adie" be broken, and the instruments recommended by the Medical Board Bombay not arrive in time, will suffice to determine with tolerable accuracy the altitude of the Unyamisi Lakes. As regards sympisometers, they are found by the long experience of Naval officers, and the accurate hourly observations of a staff of recorders, to be useless by reason of their extreme sensitiveness on this coast within 6° or 8° N. and S. of the Line. This however might not be the case on land.

For a reference point of known pressure, I am happy to say we can now confidently apply to Zanzibar. Mr. Apothecary Frost, an able and accurate observer, has during the last ten months filled up Meteorological tables with the Barometer,—probably the same instrument sent by the Bombay Geographical Society in 1847,—with Thermometer attached and unattached, wet and dry bulb, evaporating dish, and with the rain gauge. As the Society seems to take an interest in these observations, I have the honor to transmit copies with which Mr. Frost has obliged me.

I now proceed to answer your letter paragraph by paragraph.

For enquiries into the hydrology of the region which we purpose exploring, I shall be careful to provide myself with a dish and a gauge. The professionally learned however must not be exacting in their demands for observation. These African explorations present peculiar difficulties. An expedition into the Eastern Interior is a small campaign, in which the traveller is beset by all the troubles, hardships, and perils of savage warfare. He must despair of studying "infusoria," unless at least he have nothing else to do.

The Missionaries and all acquainted with the country have wondered at our using instruments at Usambara :—the dazzle of a sextant makes every man thirst for your blood. The climate also is hostile to the traveller in more ways than one. Captain Spike, my well tried and energetic companion, has twice suffered severely from sickness, jungle fever and catarrh,—in consequence of exposure to disc whilst taking observations. The simplest geographical operations become at times impossible. During our two days and two nights at Fuja, a dense poll of clouds overhung the sky, the rains had set in, though the half of February had not till elapsed; we never saw the sun, and we could not find even a star we had descended the hills. In these regions, the traveller's chief study must be to make things easy, to take all easy, and do only what is easy. I doubt the route crossing any great mountain ridge as you suppose : it leads, say the Arabs, with a steady rise and an occasional ascent, between the coast and lake. As regards our altitudes on the way, we can boil Thermometers and register the Barometer;—for objects off the line of march we must depend upon compass bearings, a Pedometer horse-line and vertical angles observed with a large or small sextant. I have the honor to forward a few specimens of the coast formation : but for the sickness which cut short our journey, our collection would have been less meagre. The mountain zone, like Zanzibar and its adjacent Islands, is a mass of corallines, often shelly and coated with red, yellow and black argillaceous soils, rendered fertile by decayed animal and vegetable matter. In some places there are distinct sea-beaches rising 100 to 150 feet above the alluvial plain. In others I could find none.

From Mombas to the Panjany river (the tract called in Sawahil "Mrima" or the Mountain Region) stretches a broken line of sandstone at some distance from the coast, and varying from 700 to 1,200 feet above the sea level. The interior is gneiss, quartz and sandstone, with detached hills of tufas and grey granite: the latter is so micaceous that the Belooch garrison cannot banish their belief that it contains gold. As at Madagascar no limestone appeared, and the result of enquiry is a doubt of its existence. I

inspected many wells and excavations upon the coast, and rarely saw either blue clay or tree roots underlying the gravel. The habitat of the Cocoanut is chiefly the Coralline coast, but it extends along the Panjany river, and bears fruit at least 30 miles from the sea ; wherever it is found at any distance from the main stream the natives judge water to be near.

The ripe Copal (called Gum Animi in the London market) is the most interesting production of Eastern Africa. "This semi-fossil is not generally " washed out of streams and torrents," but dug up especially during the rains by the Sawahili of the coast and the savages of the interior. There is, however, a kind of gum called by the natives—who deeming it the Egesta of whales, know no use for it—" Damar." Found upon the sea, especially about Cape Delgado, it floats, whereas copal sinks, in water : it may be unripe gum washed from the shore during the wet monsoon. The whole of this coast produces the real copal of commerce in different degrees of excellence. Specimens have been brought to Zanzibar from Brava and Magdishu (Magadoxo). Small quantities are found in the Rabai hills behind Mombas, and the tree grows in the jungle-patches which stud the range. From Panjany southwards for 80 miles it is plentiful, at distances varying from three hours' march to two days' journey from the coast. It would be impossible for us " to trace the position and circumstances of the extinct forest, of which it now constitutes the principal remains." Such an investigation would require at least two months' voyaging along and dwelling upon the fatal sea board. In most places, I am told, there is now no sign of a tree.

Of Gum Copal these regions supply two great varieties :

1. Raw, popularly called " Jackass Copal," is, I venture to opine, the gum which, exuding from the trunk or branches of the live tree when injured by elephant or man, fall to the ground, and either infiltrated, or was covered by successive layers of soil. Like a common resin it is softened by spirit, and becomes viscid in the solution used for washing ripe copal. This variety is exported in considerable quantities from Zanzibar to China, where, it is said, the people have discovered and retained to themselves the secret

of working it. At Bombay and Surat, it is made into an inferior varnish for carriages and palanquins.

2. The ripe or true copal—a semi-fossil, doubtless the product of forests overthrown by gradual decay by the upheaval of the coast or by some violent agency of the elements. This is proved by the fact, that pieces of the gum are met with embedded in wood, which crumbles to dust under the touch, and by its "goon-skin," which is the impress of sand or gravel. There are many varieties of colour, caused probably by the embedding strata, the clearest and most transparent fetches the highest price; then follow the numerous and almost imperceptible gradations of light amber, lemon and dark yellow, red and tufas. I have seen a specimen of tender green. Sometimes the gum, like Sicilian amber, contains drops of water, bees, tics, flies and other insects, delicately and completely preserved, and disproving a remote antiquity.

Without entering further into theory, I will simply describe two visits which I made to the Copal-diggings. On the 10th May, I rode out from the Town of Zanzibar upon the Mony road. One mile east of the town lies a low sandy plain covered with sedgy grass, and pitted with holes two or three feet deep, from which copal had been dug. The place is about a mile from the shore, apparently but few feet above high-watermark, and bounded landwards by a sandy nullah. Passing the palace of Mony, some one hundred yards, I was shown a torrent bed, where during the rains copal is said to be brought down and picked up by slaves. Thence turning towards the interior we rode up the rising ground, to judge by the eye, about one hundred feet above the level of the sea, for a mile and a half into an estate, belonging to the prince, and called Rauzah. Here were many traces of copal diggings. The soil is a dark vegetable mould varying from a foot to a foot and a half in depth, based upon blue clay, the raised sea beach. This clay becomes exceedingly fat and adhesive, clogging the bar the deeper it is excavated; it is mixed throughout with fibres, said by the negroes to be roots of the Cocoanut tree half decayed, and of bright red: blood colored bits of earth also variegated the faint blue color, and at a depth of about two feet and a half, water began to

exude from the greasy walls of the hole. The copal is here found in the vegetable soil overlaying the blue clay.

On the 13th May, I started from Saadan, a haven on the mainland, opposite Zanzibar, in company with the Akida-ao, or Mucuddum of the copal diggers. Passing over an alluvial plain, covered with rank vegetations, acacios, thorns and spear grass, after walking three miles I was shown the copal tree. It is growing in a thicket upon a flat covered with toddy and fan palms, but no cocos; it stands about thirty feet high, and measures in girth three feet. Gum exuded from the bark, and in securing the specimen of the wood herewith forwarded, we were pitilessly assailed by a large ginger-colored and semi-transparent ant whose very bite drew blood. The copal tree is rare on this part of the coast: within the space of several hundred yards I saw two only.

Another mile brought us to a distinctly defined sea beach rising about 150 feet in a swell from the plain, marked by a regular line of quartz and quartzose pebbles and crowned with luxuriant thickets. The soil is sandy, and here as on the flat below are frequent traces of the copal digger. Our guide was induced to cut a stick to sharpen it, and to scrape up the earth which produced several bits of gum. One of the slaves dug a pit about three feet deep; the color of the sand became redder as he went lower, crimson fibrous matter appeared, and presently the ground seemed to be half copal, half sand. He assured me that there is no subsoil but this red sand, and that his people never dig deeper than a man's waist.

The whole of this land from Panjan to Mboamaji may be called the copal coast: it affords an apparently endless supply of the gum. Copal is obtained by scraping the sand, even in places washed over by high tides, and often when digging holes, to fix the poles of houses, the people come upon it. That of Saadan is poor compared with the produce of Wande and the Southern harbour. On the mainland it costs half price of what is paid upon this Island, and the lazy inhabitants of the villages can never be induced to dig whilst they have a handful of food remaining.

The copal tree (Vateria Indica? or Hymenœa Vermicosa?) is still found in the Island and on the mainland of Zanzibar. It is not

as was supposed a small and shrubby thorn nine foot high : from its towering stem canoes sixty feet long have been made and a single trunk has sufficed for the kelson of a brig. The green wood is gummy; whole flakes at times adhering to the saw. When dried it is well veined of a light tint, and has been used for the pannels of doors: when oiled and polished it darkens to a yellowish-brown. Its small branches freshly cut make good and pliant sticks for chastisement.

I have the honor to forward the best specimens procurable of the superficial soils, in which the gum is chiefly found, the underlying blue clay, the reddy earth that is found mixed with the latter, a piece of copal, branch and leaves, and a bit of the gum here called "Damar." Unfortunately the copal tree was not in flower or fruit : the people assured me that it bears a berry not unlike a grain of Indian Corn.

The merchants of Zanzibar (mostly Germans and Americans) are not likely to throw away an ounce of serviceable copal, and they have consulted the ablest European Technologists upon the subject of preparing it to the best advantage. Supply certainly no longer meets demand, but that golden rule of political economy full of exceptions in civilised regions, in these latitudes becomes a sad fallacy. There is an inexhaustible supply upon the coast of East Africa, but "hands" are wanted. When there is little rain and the ground is hard, the lazy savage will not dig. Moreover "Kizkazy copal"—excavated in the N. E. or dry monsoon—annoys merchants by the difficulty of washing off the hard sand which adheres to its surface. Whenever upon the coast there is either a blood feud—and these are a legionary host—or a drought, or a famine, or a pestilence, the people strike work and dollars are offered in vain.

I must leave, Sir, to your ingenuity the task of remedying these evils. European labourers cannot be employed, the climate of East Africa, as has been abundantly proved is not less injurious to our constitutions than the worst parts of the Western coast. Indian coolies, the only procurable hands, would fear to face the wild men, some of whom I believe to be inveterate canibals. If

they did summon courage they would loose their lives, and justly enough, for trespassing upon other people's property. A large gang (say 500) of good fierce negroes from Kilva (Quiboa) and the southern parts, might be taught to use a proper mattock instead of the child's plaything now employed, and each man woul doubtless procure twelve or fifteen lbs. per diem; but the Imaum's Government would probably object, as a late treaty enables it to do. The Lawahili Mtua Mkuba or muccadum of the copal diggers would require propitiation, and to prevent the labourers running away, it would be necessary to enter into arrangements with all the chiefs of tribes, villages, and harbours. It is to be feared that such an operation, commercially speaking, would not pay. Willingly therefore as I would wish that highest of meeds, the gratitude of my fellow countrymen, by reducing the price of carriage-varnish, I must fairly confess it to be beyond my powers. The sole remedy for the manifold diseases of this Bona Terra with its Malaguns is time:—perhaps an occasional East African expedition might be administered to advantage.

We have, I am happy to say, shaken off the miasmatic fever of the coast, and are ready to set out again when the rains show any signs of abating. Dr. Steinhauser has not yet joined us, but we are in hourly hopes of the welcome event: his presence will be a no small comfort in a sickly climate, and where we must expect to suffer from the hardships, exposure, and various incidents of African exploration.

I have the honor to be, Sir,
Your most obedient Servant,
RICHARD F. BURTON, Bombay Army,
Commanding E. A. Expedition.

SCIENTIFIC INTELLIGENCE.

The Scientific Expedition of the Austrian Frigate "Novara."

His Imperial Austrian Majesty's Frigate *Novara* is now in the Indian seas on her voyage by circumnavigation, having arrived from the Cape of Good Hope and Rio de Janeira. The vessel left Trieste in April 1857, with instructions to be absent for 3 years.

The staff of Savans attached to this exploring expedition is composed of the following gentlemen.

1. Dr. Carl Scherzer, known through his travels in Central and North America, performed in company with Mr. Moritz Wagner. The narrative of his visit to Nicaragua, Paraguay, &c., under the auspices of the British Government has been published both in German and English : he accompanies the expedition for the purpose of making Ethnological and Statistical Inquiries.

2. Dr. Ferdinand Hoch Stetter, Member of the Geological Institution of Austria, Physicist and Geologist to the Expedition, son of the traveller where Abyssinian plants were distributed to the subsribers to the *Uris itineraria*. This gentleman has published a variety of Geological and Mineralogical researches, amongst which is a Geological map of Bohemia. He is in charge of numerous sets of valuable lithographs, and of duplicate collections of minerals supplied by the Geological Institute of Vienna, with a view to reciprocal interchange with the Scientific Societies of Eastern Asia.

3. Dr. G. Franenfeld, the Custodier of the department of Invertebrate Animals in the Imperial Museum at Vienna. He accompanies the Expedition as 1st Zoologist, especially for the lower classes of animals. He is well known from his travels in Egypt, his Report upon Gall Nuts, his description of the parasites on Cheixoptira, &c., published in the Transactions of the Zoological and Botanical Association of Vienna. He is a most indefatigable Naturalist. Franenfeld and Hoch Stetter were specially selected by

the Academy of Sciences to accompany the Expedition, and it was not originally intended that there should be any other Naturalist. However, by order of the Archduke Ferdinand Maximilian, Lord High Admiral of the Indian Navy, and Prime Mover of the voyage of the *Novara*, Dr. Scherzer already named, and the following gentlemen were added.

4. Mr. J. Zelebor, in charge of the Ornithological Department, of the Imperial Museum, an able Ornithologist and Taxidermist, accompany the Expedition as 2nd Zoologist, specially for the higher classes of animals. He has travelled in Persia and Egypt, whence he brought back a remarkable collection of live animals. Mr. Zelebor was on the point of starting for the West Coast of Africa for the special purpose of bringing back a live specimen of that extraordinary monkey *Troglodytes Gorilla*, (the great Chimpanzee,) when he was ordered to join the Expedition of the *Novara*.

5. Dr. Schwartz, one of the Physicians on board, was added to the staff of Naturalists for the purpose of making Medical Inquiries and Botanical collections. He has already obtained many objects of great value, amongst which may be mentioned the skeleton of a Bushman from South Africa.

6. Mr. A. Felineck, of the Botanical Garden at Vienna, attached to the Expedition as Seed-Collector and Conservator of Vegetable Products.

7. Mr. Selleny, one of the most talented Painters in the Austrian Capital.

8. The whole Expedition is under the charge of Baron Wullersderf, himself an eminent Astronomer and Physicist. He was formerely Director of the Observatory at Venice. These Naturalists have been furnished with printed instructions, compiled by the most eminent Savans in Austria. The venerable Humboldt himself contributed a long list of Physical and Geological Inquirenda. The Expedition will make a stay of some weeks amongst the Nicobar Islands, the two larger ones of which are to be surveyed. The Frigate will then proceed to Java, New Zealand, &c.

NOTES AND QUERIES.

[The following propositions have been submitted, relative to a system of Notes and Queries, by Lieutenant Hawkes, and we think their adoption will be followed by the receipts of much curious and interesting information.

Measures are, however, about to be adopted whereby a less lengthened period will elapse between the receipt of, and reply to, any queries.

Any communications intended for insertion, in reply to the questions now submitted should be forwarded to the Secretaries of the Society with the least practicable delay.

All questions received will be published at the Monthly Meetings of the Society and entered seriatum in all future numbers of the Journal under the special head of NOTES AND QUERIES.]

RULES.

(1) Notes and Queries submitted by correspondents should be confined to those of a scientific and literary character; the queries should be put, and the answers given in the plainest and most concise form. As several communications will frequently be sent in answer to the same query, the *substance* only of these will be given; except where the answers differ in material points, when the opinions of each writer will be recorded.

(2) Correspondents in forwarding Notes or Queries should authenticate their letters, not only for the satisfaction of the committee, but chiefly as a means of communicating with the writer should further enquiry be necessary. The name of the correspondent will be appended to his first communication, and his initials to all subsequent notes, &c.

(3) Notes and Queries will be numbered separately and consecutively.

NOTE.

(1) *On Mr. Rarey's system of horse-taming.*—An American paper intimates that it is cognizant of the peculiar secret possessed by Mr. Rarey, and used by him in subjugating the most vicious horse. " The chief secret," according to the Advertizer, " consists in raising one of the forefeet of the horse doubling the knee and keeping a strap round the fetlock fastening the foot close to the

arm or shoulder, the horse then stands upon three legs. Having next put on a surcingle, pass a long strap or rein through the surcingle and fastening one end of it around the fetlock of the other forefoot, attach the other to the surcingle after the animal is thrown, so closely as to deprive it of the use of the limb. In this item the treatment may be varied in fastening, the second fetlock to the arm or shoulder, after the animal is down. This plan " says the Advertizer" is successfully practised by many skilful horsebreakers in Western New York, and the horse yields to the necessity of the case, his spirit of opposition is broken"——(*From the Home News*, 17*th March*, 1858.) *H. P. Hawkes.*

QUERIES.

(1) *On the effect of the venom of the Cobra on the Mungoose.*—Have any of our readers been witness of an encounter between a Mungoose and a Cobra or other venomous snake, if so what was the result? This query being put in the hope of ascertaining whether or not the Mungoose is naturally uususceptible of the effects of the poison (as some suppose) it would be necessary therefore that the eye-witness should have satisfied himself that the snake was actually in possession of fangs and a poison bag uninjured, that the Mungoose was undoubtedly wounded, and that it was kept long enough after the encounter to prove the inertness (or otherwise) of the poison on its system. *H. P. Hawkes.*

(2) *The Dæmia extensa as an antidote for snake bite.*—Are there any well authenticated cases of the cure of the cobra bite, by the inward administration, or outward application by the *Dæmia extensa (or Cynanchum extensum)* which is called in Tamil *Veli-parutti* and *Ootamani*, and in Telugu *Gurutti?* *H. P. H.*

(3) *The Company's monogram.*—What is the meaning of the numeral 4 which surmounts the Company's monogram. *H. P. H.*

(4) *On the meaning of the word " Mylay."*—The word mylay, milay or meille is used in connection with many Indian coins, as the mylay fanam, cash, &c. What is its meaning? If derived from Mylapoor as some suggest, how can its presence on the most recent coins struck in Mysore, be accounted for? *H. P. H.*

(5) *A concretion found in teak trees.*—A peculiar concretion resembling lime or gypsum is occasionally found in the heart of teak logs. It generally collects in what carpenters call a " shake" in the wood, but with this exception the logs are perfectly sound, and no communication whatever with the external air has been observed. Is its chemical constitution the same as that of the " tabasheer" or bamboo salt. *H. P. H.*

(6.) *On the curing of tobacco.*—The very great difference in quality of the tobacco of various parts of India is said to be attributable *entirely* to the mode of curing. Is this correct? could any of our readers give a detailed account of the mode of cultivation, nature of cure, and more especially of the mode of curing adopted in their own neighbourhood. The process of curing the Lunka and Trichinopoly tobacco would be especially interesting. *H. P. H.*

(7.) *On Burmese coins.*—Do any bona fide Burmese coins exist? if not what is the currency in use? *H. P. H.*

Agricultural and Horticultural Society of India.

[At the request of the Committee of the Madras Branch of this Society, we insert the following notice of the Premia for 1858, offered by the Bengal Society.

The importance, in an economic point of view, of the subjects thus brought forward, cannot be exceeded by any intelligence of a scientific character.

We trust that the long continued exertions made by this Society, and by the Government of India, may yet eventuate in the development of those resources, in which India is so rich, and which if drawn upon more largely may yet be the means of advancing her national prosperity and the wealth of her inhabitants.

The Premia for Essays are particularly interesting, and we trust that the liberal prizes offered may produce works of general and popular utility. The Fibres, paper materials, and substitutes for Gutta Percha, are all subjects of importance to every one interested in this country, and we are confident, that our own Presidency will not be backward, in the development of these articles as commercial products."]

List of Premia for 1858.

Premia for certain Articles of Raw Produce, &c., Fibres (substitute for Flax.)

For the production of any new vegetable fibre, which can be successfully applied to all the purposes for which flax is now used, and of which not less than 10 maunds to become the property of the Society.—Rs. 1,000, and Gold Medal.

Fibres (substitute for Hemp.)

For the production of a quantity of any vegetable fibre, which can be successfully applied to the purposes for which hemp is now used, and equally strong and durable, and of which not less than 10 maunds to become the property of the Society.—Rs. 500, and Gold Medal.

Fibres Rheea.

For the production of at least 25 maunds of Rheea fibre, the whole to be the produce of the party tendering it, and of which 5 maunds to become the property of the Society, to be accompanied by a detailed statement of the process followed in its cultivation and after preparation, and the cost of the same. The quality to be approved by the Society, and the fibre to be in a fit condition for the English market.—Rs. 1,000, and Gold Medal.

N. B.—In the event of there being more than one competitor, the premium to be adjudged to the best specimen.

Cotton (Exotic) long staple variety.

For the production of at least 10 maunds of good merchantable cotton, raised from foreign seed of the black-seeded long staple kind.—Rs. 1,000, and Gold Medal.

Cotton (Indigenous.)

For the production of at least 5 maunds of cotton raised from indigenous seed, of a quality superior to that now exported, and such as is likely to prove a substitute for the Upland Georgia or New Orleans cotton of the United States of America.—Rs. 500, and Gold Medal.

N. B.—The producer or producers of the above cotton must submit to the Society a statement of the mode of cultivation and cost of the same.

Substitute for Gutta Percha.

For the discovery and production to the Society of any new substance, the produce of India, which can be successfully used as a substitute for Gutta Percha.—Rs. 500, and Gold Medal.

Materials for Paper-making.

To the producer of at least 6 maunds of fibre suitable for manufacturing into fine paper, such as will prove an efficient and economical substitute for rags or other materials at present employed in India for that purpose.—Rs. 500, and Gold Medal.

Quinine-yielding Plants.

To the introducer of twenty healthy plants of South American Cinchonas, of the kind or kinds known to yield the best description of bark.—The Gold Medal.

Madder.

For the production of at least 5 maunds of Madder, raised in any part of India, of which 1 maund to be the property of the Society.—Rs. 500, and Gold Medal.

N. B.—This prize to be renewed for three years, in the event of a specimen or specimens not being sent in by 31st December 1858.

Substitute for Gunny Cloth.

For the production of a cheap and efficient substitute for gunny cloth, suitable for packing sugar or grain, of which a piece of 36 yards in length, by 2 feet 3 inches in breadth, or thereabout, to be submitted to the Society.—Rs. 500, and Gold Medal.

Premia for Essays on certain subjects.

For an approved Essay on the following subjects:—

1. For the best practical Essay on the production and relative cost of the various oil seeds of India, suitable for export.—A premium of Rs. 500.

2. For the best practical Essay on the present state of the cultivation of the date tree in Bengal, and on the best mode of in-

creasing its production and improving the manufacture of its sugar. —A premium of Rs. 500.

3. For the best practical Essay on the present mode of cultivating and manufacturing Indian fibre, yielding plants known in commerce, such as jute, sun, &c., with practical suggestions for their improvement.—A premium of Rs. 500.

4. For the best practical Essay on the present mode of cultivating and preparing the various tanning products of India, with practical suggestions for their improvement.—A premium of Rs. 500.

Prize for a Gardener's Vade Mecum.

To any person who shall produce on or before the 31st December 1858, the best practical treatise on gardening as applicable to Lower Bengal, or a Gardener's Vade-Mecum, the sum of Rs. 600.

The work must afford full directions for the culture of vegetables, fruits, and flowers, whether indigenous or such as have been introduced into Lower Bengal to the present time, giving practical hints on grafting, budding, pruning, and transplanting, with descriptions of soils and manures best adapted to certain plants; a calendar of operations in the kitchen, fruit, and flower garden, for every month throughout the year must be added, as also a copious alphabetical index.

N. B.—The Rules of competition for Essays the same as published in 1856.

A. H. BLECHYNDEN,
Secy. A. and H. Society.

METCALFE HALL;
Calcutta,
April 1858.

The Late Dr. Stocks of the Bombay Army.

We are indebted, for the following interesting notice of the late Dr. STOCKS, to Vol. VI. of HOOKER'S JOURNAL OF BOTANY. In

giving it insertion we cannot fail to record our deep and sincere regret at the loss of one of the most distinguished Indian Botanists, we trust that Dr. STOCK's researches, into the *Natural History, &c., of Scinde,* may not be lost; but, that their publication may be undertaken, by some one competent to present them to the public, with that care which their interesting nature and undoubted merit equally deserve.

Our contemporary thus records the death of *JOHN ELLERTON STOCKS, Esq., M. D., BOMBAY MEDICAL SERVICE.

This event took place at the residence of a relative, where he was on a visit (with an unmarried sister), Samuel Watson, Esq., of Cottingham, near Hull (his native town) at the early age of thirty-four. He received his medical education at University College, London, and profited more than most students by Dr. Lindley's Botanical Lectures. He entered the East India Company's service on the Bombay Establishment, and was soon appointed Vaccinator in Scinde, and afterwards Inspector of Forests there. His travels in Scinde and Beloochistan were frequent and extensive, and he took advantage of them to improve his knowledge of the Botany of all this remarkable region, which he showed to have a close affinity in its vegetable products with Arabia and Egypt. His collections of specimens were very extensive, and well prepared; and the drawings, done by native artists, under his immediate inspection, are no less so. On Dr. Gibson's visit to England, about three years ago, Dr. Stocks was appointed during his absence to the important duties of Conservator of Forests and Superintendent of Botanic Gardens in Bombay, which gave further opportunity of pursuing his Botanical researches, both personally and by means of Collectors. His ambition now was to turn these large collections to account, and to come to England, where alone he could determine the correct nomenclature of the Genera and Species, and where he hoped to publish the new plants, and to distribute his specimens in the manner that would be most beneficial to the cause of Botany.

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* Hooker's Journal of Botany, Vol. VI. p. 308.

Dr. Stocks accordingly came to England on furlough, bringing his collections with him, and made Kew his residence, and here he had been busily engaged since the early spring, in comparing them with authentic specimens in the Kew Herbarium, and preparing them for publication. Unfortunately his constitution had been undermined by his great labours in the unhealthy climate of Scinde; he was subject to intense neuralgie pains in the head and neck, and a change of air and scene was deemed desirable. He accordingly spent a few weeks with relations in the Isle of Man; and on his way thence to Cottingham he caught a cold, which was succeeded by fits of apoplexy which, in a very few days, terminated fatally, on the afternoon of Wednesday, the 30th August.

Dr. Stocks had brought to England materials, in a very forward taste, for a general work on the Natural History, manners, customs, arts, manufactures and commerce, agriculture, &c., &c., of Scinde, which it is yet hoped may be found worthy of publication. Great talent and great research had been bestowed on it, and the information it contains is much of the same nature as that of the late Dr. Francis Buchanan Hamilton's History of the Mysore, but possessing the further advantage of being written in a lively and agreeable style, and rendered doubly valuable from the amount of Scientific knowledge of the highest stamp brought to bear upon it. Few men of his years were more extensively read in all subjects connected with the improvement of India, than Dr. Stocks. In that country his death will be much felt, and sure we are that to his personal friends the loss is irreparable, for he possessed a most kind and amiable disposition.

Like Mr. Winterbottom, Dr. Stocks was more gratified by being useful to others than in coming forward as an author; and it was only by the urgent entreaty of his friends that he could be induced to appear in that capacity. Most, if not all, that has yet been printed from his pen, we have been privileged to publish in our Botanical Journals. In the "London Journal of Botany," Vol. vii. p. 539, will be found some notes on the Botany (chiefly economic) of Scinde, describing some of the numerous vegetable products he had presented to the Museum at Kew. At page 550 of the same volume, is a most lively and spirited letter, written during "a Bo-

tanical excursion to Shah Bilawul, in Beloochistan." In the present Journal or "Kew Garden Miscellany," Vol. i. p. 257, is an excellent Memoir on two Balsom-trees (*Balsamodendron*) of Scinde, B. *Mukul* and B. *pubescens*, with two plates. In Vol. ii. p. 303, will be found an excellent general sketch of the Botany of Beloochistan, written after a second journey into that country. In Vol. iii. are descriptions and figures of two new plants of Scinde. Vol. iv. contains descriptions of thirty-seven Beloochistan plants, chiefly new species. His last communication will be seen at p. 314 of the same volume "Notes on the Botany and the Government Gardens of Bombay."

PROCEEDINGS.

The Managing Committee of the MADRAS LITERARY SOCIETY *and Auxiliary of the Royal Asiatic Society, held their usual Monthly Meeting at the Club House, on Thursday the* 11*th February at* ¼ *past* 6 *o'clock P. M.*

The Honorable Walter Elliot, Esq., in the Chair.

Read a Letter from M. Haidinger, Director of the Imperial Geological Institute of Austria, with a Memo. of Publications presented to the Society, viz :—

1. Transactions of the Imperial Geological Institute Vienna, Vols. I, III.

2. Annual Report of the Imperial Geological Institute, Vols. I, VI.

3. Natural Historical Transactions published by Haidinger, Vols. I, IV.

4. Notes on the Communications of the Naturalist of Vienna—Vols. I, VII.

These valuable works relate to the Natural Sciences generally but to Geology more especially, and are beautifully illustrated :

many of the Lithographs being coloured, and some of them are Chromo-Lithographs.

Read a letter from Mr. H. Smith, Superintendent of the Government Press on the subject of Nature Printing, in which Mr. Smith with reference to the remarks which took place in discussion at a former Meeting, claims for his process a greater degree of originality than was then supposed to be his due. Mr. S. points out that the essential difference between Mr. Cox's process and his consists in this, that the ink is applied directly to the object and that the impression is produced by vertical pressure, whereas in the other it is obtained by the action of Rollers. The correctness of this distinction was fully admitted, and the more clear delineation of Mr. Smith's impression was illustrated by examples which met with the Society's approbation.

It was resolved that the following Institutions should be added to the list of those with which the Society exchanges its publications.

The Imperial Geological Institute—Vienna.

The Royal Academy Science—Berlin.

The Royal Society—Edinburgh.

The Linnæan Society—London.

The Royal Irish Academy—Dublin.

The Committee beg to acknowledge receipt of the following paper from the Chief Secretary, Report of the Vegetable Products of the Pulney Hills with Catalogue of the Flora, by Lieut. R. H. Beddome, Assist. Conservator of Forests. This interesting communication will appear in next No. of the Journal.*

The Managing Committee of the MADRAS LITERARY SOCIETY *and Auxiliary of the Royal Asiatic Society, held their usual Monthly Meeting at the Club on the evening of Thursday the* 18*th March* 1858.

The Honorable Walter Elliot in the Chair.

The usual monthly statement of the Society's Accounts was read and passed.

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* Vide page 163.

Mr. Elliot exhibited to the Meeting, specimens of the curious genus Sagitta, the precise position of which in the Animal Kingdom has not been determined, some, as Huxley, regarding it as approaching the Annelidæ, others, as the late Professor G. Forbes, considering it more closely allied to the Molluscs, while a third party are inclined to view its nervous system as exhibiting an affinity with Crustacea.

These were received from Captain Toynbee of the *Gloriana*, with a number of minute Pelagian shells also shown to the Meeting. Mr. Elliot regretted that the departure of the *Gloriana* prevented Captain Toynbee from exhibiting the numerous beautiful drawings, executed during his Voyage, of microscopic marine objects, indicating many new forms of Crustacea, Tunicata, Acalephœ and Molluscs, which he would otherwise have done. He had however transmitted through Mr. Elliot for presentation to the Society, a MS. Translation from the German of some portions of Vogt's letters on Zoology, relating to these families, which he had found of use in his own researches. It was resolved that these papers should be printed in the Journal.

Mr. Elliot also read letters to his address from Messrs. Herman and Robert Schlagentwait, the former giving an account of the progress made in completing their calculations and arranging their collections, the latter proposing some Rules for the Orthography of Indian Names which they have proposed adopting in their forthcoming Publications.

The printed list of the Materials forwarded with their letters, contains 43 Volumes, the result of their own labors, and 38 Volumes of Observations communicated by others, " a most precious portion of which they add, particularly distinguished for their accuracy, is from your Presidency."

The Title of their work as fixed by the Court will be " Results of a Scientific Mission to India and High Asia," and will consist of about 9 Volumes with 50 Plates, chiefly containing positive scientific matter, one Volume only being devoted to general descriptive Memoirs in the form of Humboldt's Views of Nature, and all personal adventures being excluded.

The following is a list of the 43 Volumes of their own observations &c.

Vol. 1. Itinerary.

Vols. 2, 3, 4. Route Books.

These Volumes treat of almost every portion of the British Possessions in the East of the Countries contiguous to them. The 4th Volume contains routes communicated by the Foreign Office, Calcutta.

Vol. 5. Comparison and correction of the Instruments.

Vols. 6, 7, 8. Topography and Trigonometrical Measurements.

Vols. 9, 10, 11, 12. Astronomical determination of Places and Magnetical Observations.

Vols. 13, 14, 15, 16. Hypsometrical Observations and indications of the Barometer.

Vol. 17, 18, 19. General Meteorology and degrees of temperature of the Air.

Vol. 20. Rain, Height of Clouds.

Vol. 21. Optical phenomena of the Atmosphere, Observations upon Dew, Glaciers.

Vol. 22. Degrees of temperature of Rivers.

Vols. 23, 24. Degrees of temperature of the earth at different depths.

Vol. 25. Observations on the Physical state of the Sea. Portions of Sea water and River water for analysis.

Vol. 26. Observations upon Springs. Cold and hot Springs.

Vols. 27, 28, 29, 30. Geological Observations.

Vols. 31, 32. Geological Collections.

Vols. 33, 34, 35. Hydrography of rivers.

Vol. 36. Observations on the temperature and depth of subterraneous waters.

Vols. 37, 38. Measurings of the different races of men.

Vol. 39. Geographical Vocabulary of the names of places. Etymological and Ethnographical Remarks.

Vol. 40. Zoological Remarks. Zoological Collection, Ethnographical Collections.

Vol. 41. Geography of Plants, periodical phenomena of plants. Snow limits.

Vol. 42. Diameter of trees. Names of trees and plants, also the use of plant. Collection of Plants.

Vol. 43. Letters and reports to His Majesty King Frederick William IV. and to the Honorable Court of Directors of the East India Company, and to Alexander Von Humboldt.

These are merely the Headings of the different Volumes. The detailed Catalogue is in the Library of the Society.

The Scientific observations have been made in all parts of the British possessions in the East and Highlands of Asia, and with every variety of instrument.

Among other matters of interest, Mr. Herman Schlagentwaite stated that he had prepared a valuable Ethnographic Series of Casts of Heads of the various Indian races amounting to about 25, which had been executed in copper by the Galvano-plastic process with great success, and a specimen of which he had forwarded by the Overland Mail, but it has not yet been received.

He adds that no tidings have been received of their brother Adolphe since May last, which was a source of great anxiety to them.

Mr. Robert Schlagentwaite's Orthographical Remarks related chiefly to the use of the proper equivalents for the letter * * * which English writers usually represent by *j* & *ch*, but which the Germans prefer expressing by *dz* & *ts*. This subject was referred for report to the Sub Committee of Papers.

Lieut. H. P. Hawkes forwarded the first of a series of Papers which he proposes submitting to the Society, entitled "Notes on various subjects."

Those contained in the present communication are :

1. On the best material for lining entomological cases.

2. On an artificial method of preserving duplicate specimens of Lepidopterous insects in a portable form.

These were referred to the Sub-Committee of Papers.

Extract from Meteorological Observations kept at the Madras Magnetic Observatory.

DAILY MEANS.

January 1858.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Ins.	
1	30·104	74·4	69·6	81·7	70·4	N N E	....	Clody.
2				82·5	67·0	N N E	....	
3	·039	72·9	68·4	82·2	67·2	N E	....	Clear.
4	·004	72·4	66·8	80·8	66·5	E N E	...	Hazy
5	29·995	75·2	66·1	81·3	71·6	E N E	....	Clody.
6	30·012	75·0	66·4	81·8	70·5	N E	....	do
7	·001	73·7	65·5	81·9	69·5	N E	....	do
8	29·957	75·1	65·3	82·3	72·1	N E	....	do
9				81·6	68·4	N E	....	
10	·955	75·5	69·4	82·0	75·9	N E	....	do
11	.940	76·4	71·3	83·6	74·0	N E	....	Ovcst.
12	·947	73·8	68·9	81·2	68·7	N N E	....	Hazy
13	·976	74·9	69·0	82·7	69·9	E by N	...	do
14	·993	75·4	69·8	84·2	70·3	E by N	....	do
15	30·002	74·1	69·4	82·7	68·7	E N E	....	do
16				80·5	67·1	E N E	....	
17	29·994	71·6	67·2	80·6	65·6	E N E	....	Clear.
18	·963	71·1	66·7	80·9	64·5	E by N	....	do
19	·949	72·3	67·6	81·4	66·8	E N E	....	do
20	·943	72·0	67·3	81·8	65·3	?	....	do
21	·896	73·9	68·4	84·7	67·2	?	....	do
22	·919	74·4	70·1	83·1	68·5	S	....	do
23				83·1	67·9	E S E	....	
24	·963	74·1	69·1	82·7	67·1	E by S	....	do
25	30·033	74·7	69 0	83 2	68·3	S E	....	do
26	·020	75·0	69·2	83·8	69·3	E S E	....	do
27	·027	73·3	66·2	82·7	65·5	E	....	do
28	·051	74·3	68·3	82·7	68·0	E	....	do
29	·078	73·5	67·7	82·3	66·2	E N E	....	do
30				85·1	75·6	E N E	....	
31	·084	75·3	69·0	83·1	69·1	E N E		Hazy
Mean.	29·994	47·0	68·1	82·4	68·8		none.	

February 1858.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Ins.	
1	30 046	72·0	67·2	83·1	63 8	E	....	Clear.
2	·055	72·3	66·6	84·6	64·7	E S E	...	do
3	·028	73·4	69·0	84·2	67·0	S	....	do
4	29·983	74·4	69·5	83·1	67·5	S E	....	do
5	·975	73·3	67·3	84·3	66·5	S S E	....	do
6				85·7	69·3	S S E	....	
7	30·009	77·7	72·6	86·6	73·8	E S E	....	Hazy
8	·006	78·0	73·5	85·7	72·5	E S E	....	do
9	·005	76·7	71·8	85·1	69·9	S E	....	Clear.
10	·005	75·9	70·6	85·5	69·5	E S E	....	do
11	29·982	76·8	72·0	86·6	70·6	E S E	....	do
12	·950	77·7	72·8	87·5	72·0	S S E	....	do
13				86·6	72·7	E by S	....	
14	·962	77·8	72·7	85·7	72·8	E by S	....	do
15	·996	77·8	71·9	85·6	72·3	E	....	Hazy
16	30·041	76·6	67·9	83·9	69·7	E	....	Clear.
17	·056	76·7	67·3	84·4	70·0	E	....	Hazy
18	·034	75·5	67·0	84·0	67·0	E by N	....	Clear.
19	.000	73·5	66·8	83·8	65·9	E by N	....	do
20				85·9	69·8	E by N	....	
21	29·994	77·6	71·7	86·4	74·3	E by N	0·020	Hazy
22	30·026	78·6	72·3	85·7	73·5	E by N	....	do
23	·018	76·8	71·4	85·7	70·6	E	....	Clear.
24	29·974	77·2	71·1	86·6	70·0	E by S	....	Hazy
25	·928	77·3	70·9	86·4	70·1	E S E	...	Clear.
26	·935	76·9	71·4	86·2	71·3	E S E	....	do
27				87·7	72·3	E S E	....	
28	·917	78·4	72·8	87·3	72·6	S	....	do
29								
30								
31								
Mean.	29·997	76·2	70·3	85·5	70·1		0·020 Sum	

March 1858.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Ins.	
1	29·865	79·4	73 7	89·6	73·8	S E	....	Clear.
2	·858	80·3	74·3	89·6	74·7	S S E	....	do
3	·898	80·4	74·5	90 9	75·4	S E	....	Clody.
4	·907	79·7	73·5	89·1	74·6	S E	....	Clear.
5	·912	78·5	72·7	88·4	71·7	S S E	....	do
6				87·9	72·2	S S E	....	
7	·922	78·7	73·3	88·1	72·5	S S E	....	do
8	·926	78·7	72·9	87·7	72·6	S E	....	do
9	·914	77·7	72·0	86·8	71·3	S S E	....	do
10	·935	78·0	71·7	87·3	70·6	E S E	....	do
11	·953	79·2	73·5	88·4	73·4	?	....	do
12	·942	78·8	72·7	90·6	71·4	?	....	do
13				90·1	72·2	E S E	....	
14	·943	79·5	73·7	89·4	74·4	?	...	do
15	·951	78·7	73·4	88·7	72·1	S S E	....	do
16	·928	80·2	74·7	90·3	74·7	S S E	....	do
17	·927	80·8	75·2	90·6	74·3	S S E	...	do
18	·950	80·2	74·4	89·2	73·6	S S E	....	do
19	·977	79·9	73·3	89·6	73·0	S E	...	Hazy
20				91·1	72·4	E S E	...	
21	·957	79·5	73·7	90·8	72·1	E	....	Clear.
22	·924	81·4	75·5	91·3	75·5	S E	....	do
23	·926	81·6	75·5	91·4	75·5	S S E	....	do
24	·940	81·5	75·6	92·7	74·8	S E	....	do
25	·905	80·9	75·3	91·3	74·4	S E	....	do
26	·890	80·9	75·7	91·1	74·6	S E	....	Hazy
27				91·1	74·5	S E	...	
28	·869	81 9	76·2	91·9	77·5	S E	....	do
29	·862	82·3	76·1	91·7	76·1	S S E	....	Clear.
30	·823	82·8	76·8	92·7	76·9	E S E	....	do
31	·845	83·4	77·3	92·6	77·8	E by N	....	do
Mean.	29·913	80·2	74·3	90·1	73·9		none.	

April 1858.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Ins.	
1	29·891	83 3	76·9	93·2	77·1	E S E	...	Hazy.
2	·874	82·4	75·8	96·5	75·9	E S E	...	Clody.
3				91·9	74·5	E S E	....	
4	·853	82·8	76·7	93·7	78·3	S E	....	Clody.
5	·859	83·5	77·7	93·5	77·4	E S E	....	Hazy.
6	·843	84·6	77·3	96·7	78·4	E by S	....	do
7	·806	83·4	77·1	94·6	77·0	E S E	....	Clear.
8	·831	84·1	77·6	95·2	78·2	S E	....	do
9	·822	85·5	78·3	99·9	78·3	S S E	....	do
10				101·7	81.2	S by E	....	
11	·788	87·2	79·8	99·6	82·4	S	....	do
12	·816	86·4	80·6	96·2	82·9	S S E	...	Hazy.
13	·816	85·5	79·9	94·9	81·7	S by E	....	Clear.
14	·840	85·2	79·6	94·5	81·4	S E	....	Hazy.
15	·872	84·3	78·9	93·6	79·5	S E	....	Clear.
16	·894	84·3	78·7	93·7	78 9	S E	....	Hazy.
17				94·6	79·1	E S E	....	
18	·875	85·0	79·0	94 9	78·7	E S E	....	do
19	·857	84·9	78·1	95·0	78 8	E S E	....	do
20	·877	84·9	77·6	96 0	78·9	E S E	...	do
21	·902	83·8	77·2	94·8	76·7	E S E	....	Clear.
22	·875	84·0	77·7	94·2	77·4	S E	....	do
23	·809	84·3	77·5	94·1	77·8	E S E	....	do
24				94·9	79·1	S E	....	
25	·772	85·6	79·1	95·6	80·9	S E	....	Hazy.
26	·793	85·9	79·7	95·8	80·9	S E	....	do
27	·814	86·0	79·5	95·8	81·1	E by S	....	Clear.
28	·836	84·4	79·3	88·3	81·9	E N E	0·279	Ovrcst
29	·860	83·3	78·5	93·8	79·0	E	·361	do
30	·831	83·8	79·2	92·4	79·7	E by S	·192	Hazy.
31								
Mean.	29·843	84·6	78·4	95·0	79·1		0·832 Sum	

May 1858.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Wet	Max.	Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Ins.	
1				93·1	80·5	S E		
2	29·776	84·3	78 6	94·0	80·0	S E	0·014	Clody.
3	·755	81·3	77·4	83·5	80·1	N E	·584	Ovrcst
4	·618	78·9	76·7	81·7	77·7	N	·595	do
5	·729	78·1	75 1	88·8	77·4	S by W	·018	do
6	·720	82·3	78·2	92·9	78·5	S S E	·004	Clody.
7	·693	84·8	79·3	95·2	79 8	S	....	Hazy.
8				101·2	81·5	S S E	·779	
9	·733	83·8	78·6	93·7	79·0	?	....	Ovrcst
10	·740	84 4	79·2	98·7	79·2	S by W	....	Hazy.
11	·698	85·6	79·1	96·2	80·3	?	....	do
12	·667	85·0	79 1	95·3	81·1	S by E	....	do
13	·663	84·6	78·2	95 4	79·7	S S E	....	Clody.
14	·683	85·1	79·0	94·4	80·3	S S E	....	Hazy.
15				99·8	82 1	S S W	...	
16	·702	87·9	77·7	100·8	84·6	?	...	Clody.
17	·677	85·5	77·6	94·5	82·2	S W	.180	Ovrcst
18	·606	83·5	77·3	96·0	83·2	S W	·792	do
19	·616	85·3	76·6	97·6	79·2	?	....	do
20	·671	87·7	76·4	100·1	81·2	W by S	....	Clody.
21	·700	87·2	78·3	100·2	81·1		....	do
22				100·4	81·3		....	
23	.740	87·5	77·3	103·7	81·3		....	Haxy.
24	·765	88·3	78·0	103·9	82·2		...	do
25	·775	88·2	77·7	104·0	83·1		...	do
26	·761	87·2	77·8	101·4	82·1		·068	do
27	·735	85 9	77·1	100·6	80·8		....	Clody.
28	·733	87·0	78·2	100·0	81·5		....	do
29				100·2	81·7		....	
30	·798	87·9	78·4	100·5	72·3		...	do
31	·787	89·2	77·8	103·7	8 2·3		....	Hazy.
Mean.	29·713	85·2	77·9	97·1	80 9		3·031 Sum	

? This mark signifies that no Means can be taken owing to the variable state of the Wind.

Extract from Meteorological Observations kept at the Madras Magnetic Observatory.

HOURLY MEANS.

Gottingen Mean Time	Noon	1	2	3	4	5	6	7	8	9	10	11
Madras Mean Time	P. M. 4 h 41 m	5 h 41 m	6 h 41 m	7 h 41 m	8 h 41 m	9 h 41 m	10 h 41 m	11 h 41 m	12 h 41 m	13 h 41 m	14 h 41 m	15 h 41 m
Bar at 32° Farh. 1858	In.	In.	In.	In.	In.	In.	In.	In.	In.	* In.	In.	* In.
Jan.	29·944	29·955	29·973	29·997	30·015	30·022	30·017	30·008	29·997	29·984	29·968	29·965
Feb.	·948	·958	·975	·999	·019	·027	·026	·017	30 004	·989	·974	·968
Mar.	·854	·866	·884	·907	29·928	29·940	29·940	29·931	29·919	·901	·889	·883
Apl.	·773	·787	·810	·833	·858	·872	·876	·867	·850	·836	·827	·825
May.	·645	·663	·686	·708	·726	·741	·748	·737	·724	·709	·700	·698
Dry Ther. 1858	°	°	°	°	°	°	°	°	°	°	°	°
Jan.	77·7	76·3	75·0	74·4	73·7	73·0	72·3	71·6	70·9	70·2	69·4	69·0
Feb.	80·8	79·0	77·1	76.4	75·7	75·1	74·5	73 8	73·2	72·4	71·5	70·5
Mar.	84·5	82·6	80 6	79·8	79·2	78·7	78·1	77·4	76·4	75·5	74·7	74·1
Apl.	88·1	85·7	84·0	83·3	82·9	82·6	82·1	81·4	80·8	80·2	79 8	79·2
May.	88·8	86·9	84·5	83 7	82·9	82·7	82·3	81·8	81·4	80·9	80·4	80·2
Wet Ther. 1858												
Jan.	69·4	69·1	68·6	68·3	68·0	67·9	67·8	67·4	67 1	66 8	66·5	66·2
Feb.	72·4	71·8	71·0	70·7	70·5	70·2	69·8	69·6	69·3	69·0	68·7	68·2
Mar.	76·0	75·4	74·8	74·4	74·2	74·1	73·9	73·6	73·2	72·7	72·3	72·1
Apl.	79·3	78·9	78·5	78·4	78·3	78·1	78·0	77·9	77·5	77.3	77·2	76.9
May.	79·3	78·8	78·3	78·2	77·9	77·9	77·9	77·6	77·5	77·1	76·8	76·7

Gottingen Mean Time	12	13	14	15	16	17	18	19	20	21	22	23	Means.
Madras Mean Time	16 h 41 m	17 h 41 m	18 h 41 m	19 h 41 m	20 h 41 m	21 h 41 m	22 h 4' m	23 h 41 m	0 h 41 m	1 h 41 m	2 h 41 m	3 h 41 m	
Bar at 32° Farh. 1858	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Jan.	29·972	29·981	30 002	30·028	30·052	30·059	30·050	30.024	29 994	29·964	29·944	29·937	29·994
Feb.	·974	·990	·005	·027	·050	·059	·049	·024	·994	·965	·945	·937	·997
Mar.	·890	·907	29·929	29·954	29·974	29·980	29·969	29·945	·917	·890	·864	·852	·913
Apl.	·834	·846	.866	·890	·905	·902	·890	·868	·837	·809	·787	·772	·843
May.	·705	·719	·740	·757	·767	·768	·755	·732	·705	·680	·658	·645	·713
Dry Ther. 1858	°	°	°	°	°	°	°	°	°	°	°	°	°
Jan.	68·6	67·9	68·0	70 6	71 4	77·0	78·5	79·4	80·0	79·8	79·6	78·8	74 0
Feb.	69·4	68·8	69·0	72·4	76·0	79.6	81·0	82·4	82·8	82·8	82·7	82·1	76·2
Mar.	73·5	73·2	74·0	77·6	81·1	84·0	85·9	86·6	86·9	86·9	86·6	85·9	80 2
Apl.	78 6	78·2	80·1	83·4	86·3	88·9	90·4	91·2	91·1	91·0	90·5	89 6	84·6
May.	79·8	79·7	81·6	84·2	86·4	88·6	90·2	91·4	92·4	92·3	91·9	90·6	85·2
Wet Ther. 1858													
Jan.	65·8	65·5	65·5	66·8	68·7	69·6	69 9	70·3	70·2	70·2	70·1	69·8	68·1
Feb.	67·6	66·9	67·1	69·1	70·5	71·5	71·6	72·2	72·6	72 5	72·7	72·7	70·3
Mar.	71·8	71·5	72·0	73·8	74 9	75·3	75·8	76·4	76·4	76·5	76·6	76·6	74·3
Apl.	76·5	76·1	77·1	78·3	78·6	79·1	79·6	79·7	79 8	79·6	79·6	79·6	78·4
May.	76·4	75·9	76·5	76·9	77·2	78·2	78·1	78·8	79·2	79·1	79·4	79·6	77·9

* The Numbers in these Columns are not observed but interpolated for the sake of obtaining the daily Means.

MADRAS OBSERVATORY,
June 1858.

W. K. WORSTER. Capt. (Bt. Major,)
Actg. Director of the Madras Observatory.

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Plate III. Vol. III.

No. 5 N.S. Mad. Jour. Lit. & Sc.

Plate IV.

No. 5. Vol. III. N.S. Mad. Jour. Lit. & Sc.

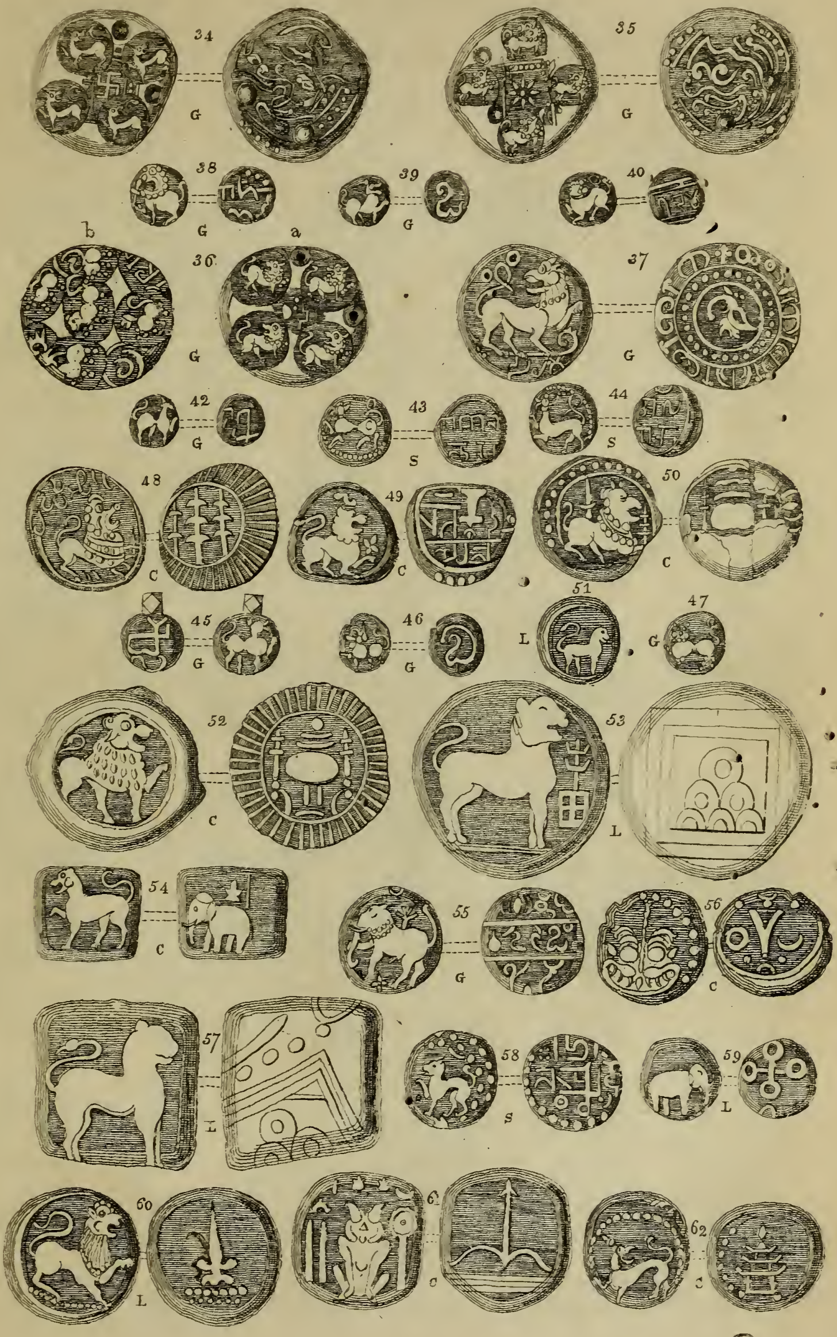
Actinopteris radiata (Link.)

Poa Tenella, (Roxb)

Śaláká or Punch Coins.

BUDDHIST COINS Nº II

Sinha Type



Buddhist Coins N° III

Elephant & Bull Types

64
65
79

BUDDHIST COINS No. IV

82.
83.
84.

Horse Type & Miscellaneous

Buddhist Coins N.º V.